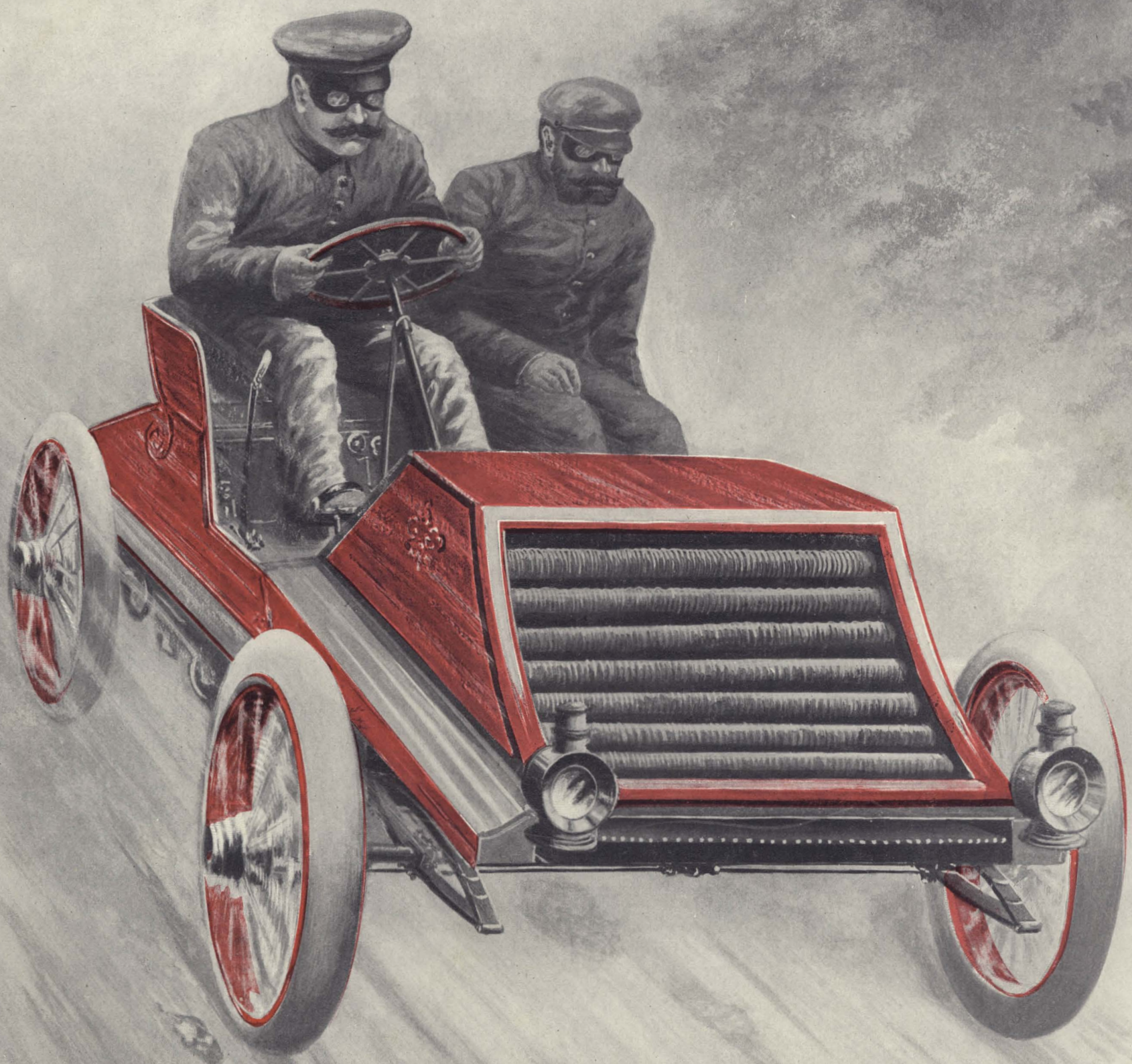
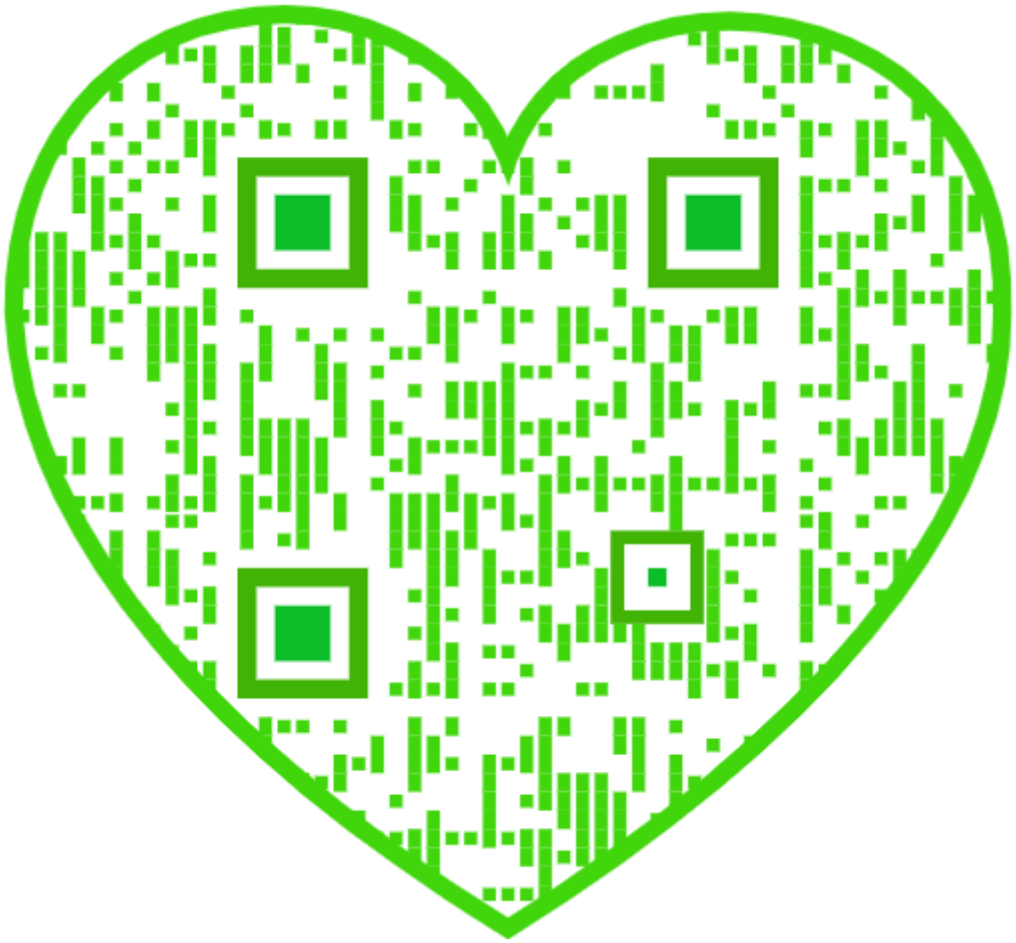
SCIENTIFIC AMERICAN



AUTOMOBILE AND OUTING NUMBER

RIGHT, 1901, BY MUNN & CO., N Y

PRICE 10¢



The Chicago-Beaumont Oil Co.'s

OIL WELL

IN BLOCK 38, SPINDLE TOP, NOW IN CAP ROCK.

A Gusher Guaranteed by Feb. 28th.

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ON THESE TERMS

10% Cash, Balance When We Strike Oil.

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IF A GUSHER IS NOT PRODUCED BY FEBRUARY 28th.

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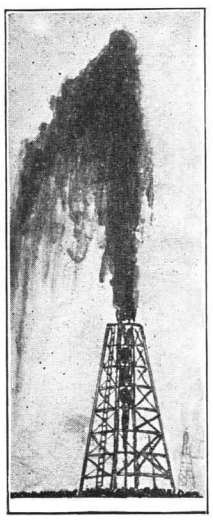

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There remain only a few days more in which to buy stock at its present price. Do not wait until gusher is brought in and its price is advanced. Now is your opportunity to make a clean and safe investment that is bound to pay handsome dividends. The par value of stock is $10 per share.

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WIRELESS 75c.

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75c. TELEGRAPH CO.

FULL PAID AND NON-ASSESSABLE.

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It is confidently believed that stock in the Northwestern Wireless Telegraph Co., the greatest commercial asset of the age, now selling at 75 cents, will be worth hundreds of dollars in the near future, thus duplicating the great achievement of Bell Telephone stock, which is now selling at $4,000 a share and not to be had. BE WISE IN YOUR GENERATION AND OWN AN INVESTMENT THAT WILL PROVE A FINE SECURITY FOR YOU AND YOUR HEIRS WHILE THIS OFFER IS YET BEFORE YOU.

We have the pleasing announcement that with the recent arrangement made with the New England Wireless Telegraph Co., controling the states of Maine, New Hampshire, Vermont, Connecticut, Rhode Island and Massachusetts, all Seaboard States, and the arrangement made with the Gulf Wireless Telegraph Co., controlling the states of Alabama, Georgia, Florida, Louisiana, Mississippi, and the rich islands of Cuba, with the important sugar, cotton, rice and manufacturing, as well as mineral wealth of the great progressive Southern States, linked in a business way with our company controlling absolute patent rights (16 in number and 8 more pending), to co-operate in Illinois, Wisconsin, Iowa, Minnesota, Michigan, Indiana, Kentucky and Tennessee, positively makes the Northwestern Company the most Gigantic Wireless Corporation in America.

The United States Navy has abandoned the use of carrier pigeons and is now ready to adopt the wireless system on its vessels. In connection with the stations between Governor's Island to Fort Wadsworth, Cape Henry and Hatteras and later stations now about completed between one of the Florida Keys and the Cuban Coast, the vast commercial possibilities of this new system are now inconceivable.

THE PERE MARQUETTE RAILWAY COMPANY HAVE APPLIED TO THIS COMPANY FOR ESTIMATES TO EQUIP THEIR ENTIRE LINE OF STEAMBOATS WITH WIRELESS TELEGRAPHY, AND ALSO DESIRE US TO FIGURE ON STATIONS BETWEEN LUDINGTON, MICH., AND MANITOWOC, WIS.—DISTANCE 62 MILES.

Within one year we believe wireless stations will be erected all over the country, securing the cheapest method of electrical communication to the public.

This company has received very powerful induction coils, capable of transmitting messages for our first stations between Chicago, Milwaukee and Waukegan, which will shortly be in operation.

Attention is called to the fact that the Great Lakes, Michigan, Superior, Huron and Ontario, with their terrific tonnage lie within our territory, as well as the gigantic grain fields of the mighty West and Northwest, in which is spent more money for telegraphy than all the other states in the Union. We require no wire, no poles, no buying of franchises, etc. The old wire system—without figuring on maintenance—costs about $2,000 a mile and by wireless less than $100 a mile.

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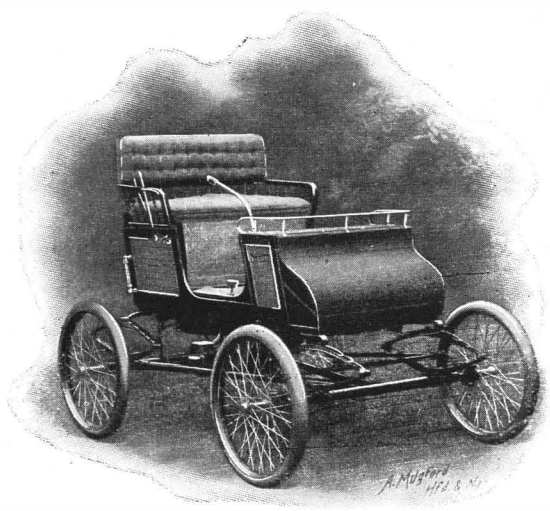
Lane Steam Automobiles



First-Class Certificate in Endurance Contest.

Engines entirely enclosed and self-lubricated.

Automatic air pressure on fuel.

Special Tube Burner.

Only one valve for firing up.

Blue flame pilot light.

Will stand under steam indefinitely.

Feed-water heater. Condensation returned to water tank.

High and low water safeguards.

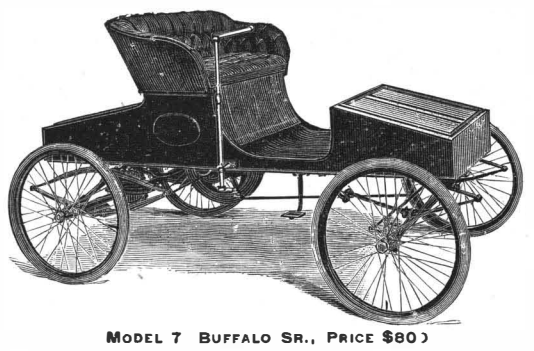
Steam siphon tank fillers, etc.

LANE MOTOR VEHICLE CO., Prospect & M Streets, **Poughkeepsie, N. Y.**

The Debut of the "Buffalo Sr."

See Them at Chicago Show

1902 Catalogs



Now Ready

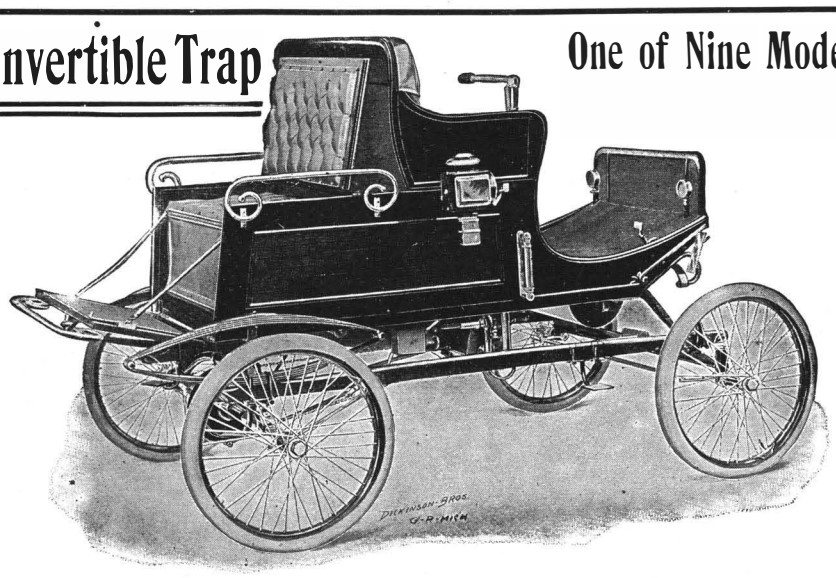
MODEL 7 BUFFALO SR., PRICE $800

Has 6 H.P. medium speed motor, 6 ft. wheel base, standard tread, 2 speed transmission and reverse, single lever, Gasolene supply 200 miles, water supply 200 miles, weight 800 lbs. We present this beautiful **Automobile,** modern type especially **designed for professional men, business men and families.** An Automobile is no better than its motor! We use only **"E. R. Thomas' World's Record Motors,"** they are the best, as thousands of users attest. Send for testimonials. Our **Auto-Bi** (Motor Bicycle) leads all others, why not our **Automobile?**

Buffalo Automobile & Auto-Bi Co., **Buffalo, N. Y., U. S. A.**

Convertible Trap

One of Nine Models

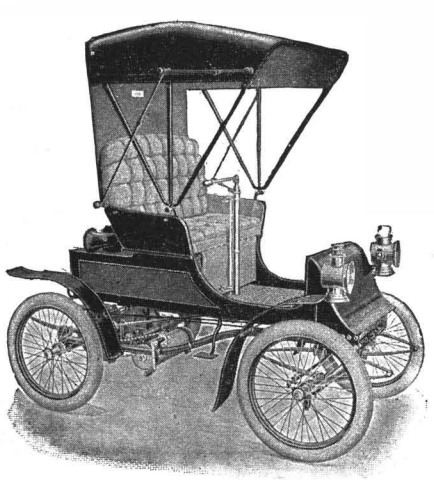


1902 Catalog Now Ready

STEARNS STEAM CARRIAGE COMPANY

SYRACUSE, N. Y., U. S. A.

Pierce Motorette



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THE GEORGE N. PIERCE CO.

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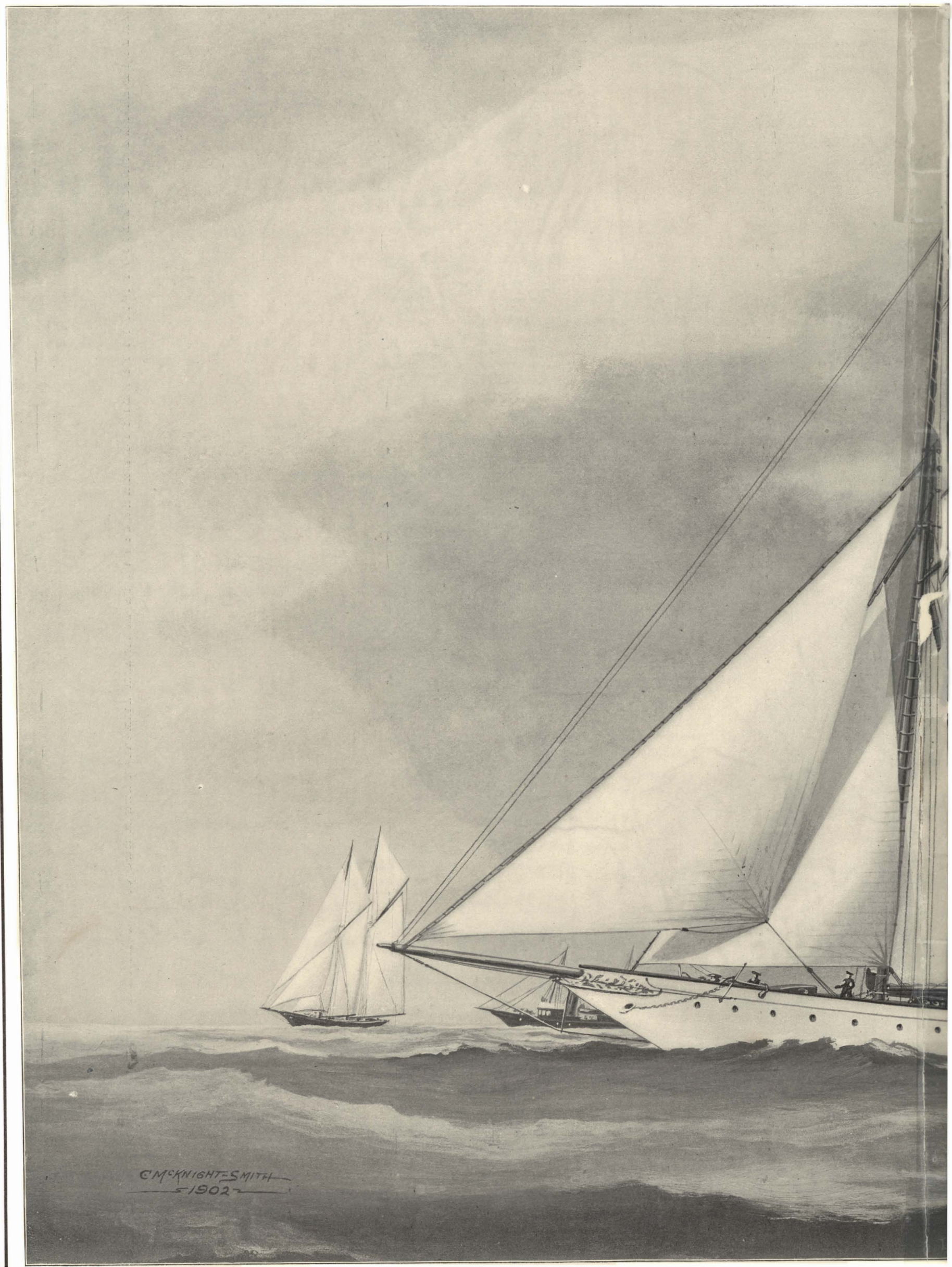

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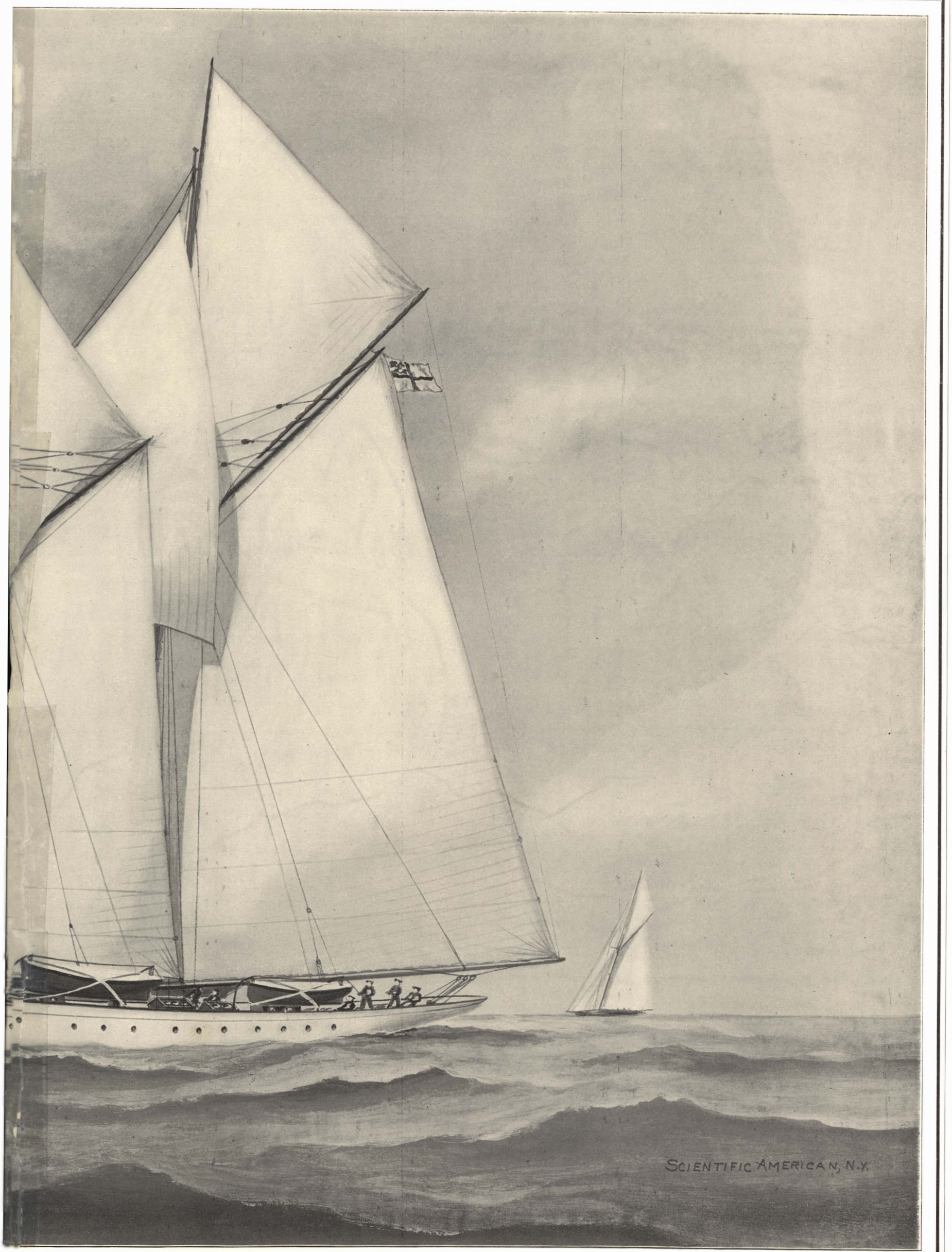
Length over all, 161 feet; Beam, 27 feet; Draft, 15 feet; Length, end of boom to tip of bows

The Kaiser's New America



rit, 195.5 feet; Height from deck to maintopmast truck, 132 feet; Sail area, 11,612 square feet.

For description see page 141.

n-Built Yacht "Meteor III."

SCIENTIFIC AMERICAN

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NEW YORK, MARCH 1, 1902.

[$3.00 A YEAR.
8 CENTS A COPY.

SOME TYPES OF THE MODERN AUTOMOBILE.

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MARCH 1, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

INTRODUCTORY.

The rise and growth of the automobile industry forms one of the most striking chapters in the remarkable mechanical development which has taken place in the last two generations. In some respects this development has been absolutely without a parallel, as witness both the remarkably short space of time in which the automobile has grown from the first crude conception to its present highly developed condition, and the unprecedented rapidity with which the industry has assumed proportions of the first magnitude. The steamship and the railroad required several decades to reach the mechanical completeness and financial and industrial importance which have been achieved by the automobile in just as many years.

The year 1901-1902 is likely to rank as one of the most important in the history of the automobile in America, and this for the reason that in no previous year was there evidence that the automobile industry was destined to assume proportions of the first magnitude. At the close of 1901, however, the remarkably successful Automobile Show in Madison Square Garden, in this city, served to demonstrate alike the admirable quality of the machines of American make; the large number and importance of the firms that were embarked in the automobile industry; and what was perhaps most vitally important of all, the thorough awakening of public interest in the automobile as such.

Scarcely have the echoes of that most successful venture died away before the public interest is centered upon another and equally important automobile exhibit which will be held in Chicago on March 1; and in connection with this exhibition, which gives promise of rivaling if not surpassing in importance and results the New York Show, we consider that the time is propitious for bringing out a special automobile issue of the Scientific American. There is no questioning the widespread public interest in the automobile, and the demand for practical information, not merely as to the construction and manipulation of the machines, but in all the collateral fields which are embraced under automobilism.

And at the outset we are free to confess that it is no simple matter to bring out an automobile number. In the first place, to be successful, it must be entirely without prejudice. From its pages must be rigorously excluded illegitimate and fake enterprises, and only such standard makes must be shown as have stood the test of time and hard usage. From the very first it was realized by the Editor that in a field so vast the choice of subjects would necessarily have to be greatly restricted, and hence it was decided to confine the issue to a description of automobilism as developed in the United States, confining the number exclusively to the description of American machines and the development of the sport and industry as affected by national conditions. Even under such restrictions it was still necessary to exercise a selective choice among the large number of American machines of undoubtedly first-class construction, many of which have had to be omitted simply on the ground of lack of space for their proper treatment. The European automobile does not figure at all in the present issue. There are, furthermore, certain conspicuous omissions which are made for the sole reason that we have so lately given them an elaborate description and illustration in the Scientific American that it would be superfluous to reproduce them in the special number.

THE AUTOMOBILE ON THE STAGE.

Amid the prospective spheres of usefulness of the automobile in these, the earlier years of its development, probably the most sanguine of its sponsors would hardly have claimed for it any histrionic possibilities; yet it is a fact that the automobile has at last "taken to the boards." In two of this season's most successful theatrical productions, the automobile plays a not inconspicuous part, and curiously enough it is the "frailties and foibles" of the machine that are selected for emphasis in each case. Thus, in a play known by the classic title of "Beauty and the Beast," some gentlemen burglars make their entrance on an automobile. They are just about to settle down to the practice of their profession, when a policeman's whistle is heard. They make a dash for the machine, which promptly, at the "psychological" moment, refuses to budge. Forthwith they let down the back of the carriage and unload a repair kit (sic) which assumes the proportions of a veritable blacksmith's shop. The repairs proceed apace; tires, sparking devices, motor, and every conceivable end of the machine being attacked in turn. The only manifest result is that the harmless-looking carriage emits steam, smoke, and gas, until it develops into a positive infernal machine, finally rending asunder and blowing up with every conventional element of realism.

In one of the latest society plays running at another New York theater, the whole of the first act is supposed to take place in Central Park. Here the hero and his wife are discovered in a crippled victoria. While the chauffeur is repairing a broken controller, a friend of the wife's enters with a broken bicycle and a sadly dilapidated costume. The rescue comes in the shape of a natty little electric runabout, occupied by an opportune gentleman friend who extricates the party from their plight. The runabout shows the electric vehicle at its best, and it is skillfully introduced on the scene to bring out the contrast between the reliable electric and the supposedly more ponderous and costly, but more uncertain gas-driven machine. Not to be outdone by melodrama and the society play, comic opera has also called in the automobile, and one of the most popular comedians of the New York stage is nightly assuming the role of a dashing chauffeur.

The burglar, the distressed heroine and the comedian have been duly presented on the boards. Surely the next thing in order in theatrical automobiling should be an up-to-date melodrama, with a real race for life or freedom in two powerful machines. Such an act could be produced with comparative ease; for the much more difficult horse-race has been successfully staged, and there is no question that such a race would be a very decided novelty.

SPECIAL FEATURES AT THE CHICAGO SHOW.

The automobiles exhibited in Chicago this week will have all the improvements that are likely to be put on the various types this year. During the last three months the manufacturers have been doing their utmost to get out new designs and novelties for the March Show, as on the merits of their machines at this time depend in large measure the orders for a year ahead. All the improvements that experience has demonstrated are necessary have been put on the new models, and the fortunate possessor of a 1902 machine should have less difficulty in getting about without breakdowns than he had with the automobile of a year ago. Some of the machines which lack of space has kept us from describing, but which have many points worthy of mention, will be found noted in brief below.

The Friedman Automobile Company's new gasoline runabout has several novel features in the way of a friction disk transmission and an arrangement for starting the motor from the seat. A new form of spark plug consisting of two separate plugs, each inclosing an insulated wire, is used on this machine, the claim being made that it is not so easily short-circuited as the regular type. The motor of the double cylinder opposed type is placed crosswise of the vehicle. The Friedman machine can be seen in New York at the store of the Spalding-Bidwell Company.

The Toledo steam carriage of the International Motor Car Company has an interesting piece of mechanism in the form of a single throttle lever, which it is only necessary to move backward in order to reverse the machine. A special water-tube boiler of original construction is also employed.

The Automobile Equipment Company, of Chicago, show four sizes of Acme steam engines in operation. Boilers, burners and Moore automatic steam air and water pumps will also be shown working. Besides well-known makes of spark coils and batteries, including the Hydra double cell, the company expect to surprise the public with a new gasoline engine igniter that requires no electricity whatever.

The Brown-Lipe Gear Company, of Syracuse, exhibit several different models of their spur gear differentials. Patents have recently been allowed on this new form of equalizing gear, which has obvious advantages over the old style bevel gear type, and has given general satisfaction during the year it has been on the market.

The R. E. Dietz Company, of New York, furnish most of the automobile lamps that are used by the trade when a simple and substantial lamp is desired. Their lamps are constructed on the tubular principle, the air for the burner being brought down from above through air passages, so that no matter how hard the wind blows this air is undisturbed and will not affect the flame.

Eastman metallic bodies for automobiles are to be seen in the Eastman booth. The metallic body offers many advantages that have not been seized upon by the American as rapidly as by the French manufacturer, who makes use of them frequently because of their lightness and indestructibility.

The new Locomobile touring car is furnished with a gasoline pump attached to the engine for the purpose of pumping the gasoline into a small receiving chamber, where it is kept under pressure and from which it goes to the burner. This does away with the necessity of pumping up air pressure in the gasoline tank, as a few strokes of a hand pump will supply sufficient pressure to start, after which the engine keeps it up.

The Auto-bi of the Buffalo Automobile and Auto-bi Company is one of the most practical motor bicycles on the market. Mr. Thomas, of this company, has had considerable experience in building motor bicycles, and the product of the new concern can be depended upon to be of the very best quality throughout.

The Prescott Automobile Company's steam carriage has been still further improved in appearance since last November by the addition of a neat dashboard to the folding box seat in front. Double-acting brakes are now fitted to the rear wheels, thus relieving the compensating gear of many strains and preventing skidding. The water level is automatically controlled in the boiler, and an improved lighter for the burner has been added.

A PRACTICAL AUTOMOBILE TOURING OUTFIT.

BY HROLF WISBY.

Quite naturally touring has become a favorite pastime with those who patronize automobiling not as a fad, but as a healthful, pleasurable sport—a class of automobilists by the way that is constantly increasing, not only abroad but also in this country. In spite of the wretched condition of American roads, the successful long distance trips made by Arthur J. Eddy and a number of less-known chauffeurs have shown that extended touring in the United States is not only possible but probably more fascinating because of the additional obstacles that are continually presenting themselves to be overcome. In the vehicles also the demand for improved touring types can readily be seen, even by inexpert eyes, in the effort of the leading makers to produce a machine especially adapted for touring. Nearly all the standard 1902 models include a distinct touring type, and some of the largest manufacturers have made such types their specialty. The tendency in this direction has thus far had a beneficial influence, both in Europe and this country, on the style as well as on the utility of the product. By dropping the racing requirements and centering all their mechanical ingenuity on the production of touring types, in which comfort and convenience must take precedence over the speed feature, automobile makers have at length succeeded, in the 1902 models, in turning out several types of touring vehicles that are decidedly superior to what was offered as a touring vehicle twelve months ago. At the present time nothing so emphatically shows the rapid advance in automobile construction as the particular development of just this class of carriage. Bodies have become lower, wheel bases have grown longer, stouter and smaller wheels have taken the place of comparatively high wheels, and the consequent changes in the vehicle proper have been such as to afford more space for the feet, an easier seat, a handier position of the manipulating devices, and increased storage capacity not only for liquid fuel but for such luggage as may be necessary to make touring convenient and agreeable.

The proper vehicle is, of course, the most important consideration in a complete touring outfit, but now that such machines can be had at a comparatively moderate price, the difficulty of getting them at all has been reduced to the problem of selecting the best one. There are other items to be considered, however. There is really no such thing on the market as a practical automobile touring outfit. Nobody makes it; nobody sells it, and yet there is an unprecedented demand for it by experienced auto-tourists, that is, those who have tried to coax pleasure out of touring without the proper outfit to make it agreeable. Such veterans generally set about making their own outfits, but many wearying experiences may have to be suffered before they possess an outfit that is complete without being unwieldy.

Everyone is familiar with the black leather clothing worn by most chauffeurs. For all-around use this is the proper and most practical clothing, and for long trips it is the only kind which has been found to be convenient and satisfactory.

Such leather clothing is usually made from calfskin, but the very best grade obtainable is invariably taken from the hide of the kangaroo—the skin being more pliable, and on account of its rather oily substance it will shed rain a good deal easier than calfskin. The latest style leather clothing is lined, not with corduroy,

but with a strong, thick flannel, especially manufactured for this use.

The proper automobile cap, with an extra long face-mask and goggles combined, and a pair of earmits, ought to keep any head comfortable during fast going on cold days. The hands are best protected by fleece-lined buckskin gauntlets with cuffs wide enough to take the sleeve and hold it in.

As a rule the novice chauffeur will do a great deal of thinking to make his initial tour a success, and generally he returns to his starting place—unless the railroad carries him—finding that he has been doing his most sagacious thinking on the wrong side of the problem. He thought of rain storms and took a mackintosh with him; he thought of a scorching sun and provided himself with a monster Panama hat; he thought of cold feet and added a footbag of furs to his inventory. Now, as a matter of fact, a mackintosh is a most irritating kind of garment when automobiling in a rainstorm. It has a tendency to fly up over the knees, interfere with the quick handling of levers, and is invariably stepped on or torn, on leaving the vehicle hurriedly. Between a kite and a Panama hat for automobiling there is but little choice, only a difference in the time elapsed before it flies off. Nothing equals a footbag for overheating the feet, and ensnaring them in such a way that if you leave the vehicle in a hurry, you are pretty sure of striking the ground head first.

In place of the mackintosh, which only affords partial protection, get a seaman's suit of oilskin clothes, which is sure to protect you completely under the most adverse weather and road conditions, while it is out of the way all of the time. Several of the contesting chauffeurs in the great New York-Buffalo Endurance Trial were only too happy to exchange their insufficient and impractical outer garments for an oilskin jacket, a pair of trousers and a so'wester to match.

Instead of the fur bags or similar contrivances for keeping the feet warm during the cold season, it is advisable to dress the feet so comfortably that they will be able to retain their natural heat even in frosty weather. The men employed in the ice-harvesting business on the Great Lakes have solved this problem in a very thorough manner. Adopt their footwear and you need never bother with furbags, soapstones and such cumbrances. Briefly described, this footwear consists of a coarse, heavy-soled rubber, laced boot, into which is slid a sort of thick felt stocking reaching to the knee. The leg is thrust into the felt stocking. This arrangement affords a rubber covering to fight off dampness, a felt shell to fight off the cold, and a trouser-leg and a pair of woolen stockings to retain the heat of the limb. Heavy woolen or flannel underwear under a sporting suit and a heavy-weight sweater ought to give comfort, especially when a corduroy-lined leather coat is the outer garment.

Furs are not advisable for long-distance touring, whereas they yield much comfort during a few hours of driving, and suggest an air of style not obtainable with more sensible clothing. Furs could be made preferable as an all-around winter garment if we would but learn from the Eskimos how to ventilate fur clothes, but there is no indication that we will ever take the hint.

During the summer season, instead of the ubiquitous Panama, the Japanese palm-leaf sun-hat will be found more practicable, since it will not fly off during the swiftest pace. The regulation auto cap, of extra light stock, would be the ideal headgear, if such caps could be had with the sweatband constructed in the same manner as that of the English army sun helmet—but hatters have yet to dream of this. A khaki suit with trousers cut on the cavalry order, so as to permit of canvas gaiters or leather leggings on the legs, would be one of the most practical things for summer wear.

Next in importance to practical clothing comes such luggage as the chauffeur may care to take along, either for his personal comfort or for camping by the roadside. The best of sportsmen in Europe are already beginning to patronize the "camping-out" idea.

To fit out an automobile for a long continuous tour, camping by the roadside, is equivalent to making the machine your nomadic home for the time being. There is nothing impracticable about it, for when a soldier is able to carry on his back his entire camp outfit in addition to his weapons, the smallest automobile on the market ought to carry everything needed to make its passengers comfortable in camp.

Breakables should be avoided entirely. Things that may be duplicated in any country store should not be given space unless "unknown regions" are to be invaded. Combustibles are to be discountenanced. A canvas tent on the military order with a folding center pole will house two people in good shape. A rubber air-mattress furnishes the best possible resting device. It is easily and quickly inflated, and can be rolled snugly to the size of a man's arm, taking up but a minimum of space. It is the best protection against ground moisture. An air cushion for a headrest, and an army blanket for bed covering, complete the camp bed. Before going to bed, be sure to lock the manipulating devices on your automobile so that no one may appropriate the carriage while you sleep. You might also place a good six-shooter under your pillow. You will sleep just as well, and it might come handy. When you make up in the morning, your breakfast is, or ought to be, in the basket you are carrying with you strapped to the stern body of the vehicle. Most of the basket outfits made for touring are most adorable objects of admiration, fit almost for a jeweler's showcase, but when you come to use them on the road your fancy is made to take many a sad shock. A better auto basket than any of those retailing from fifty to two hundred dollars can easily be improvised for a small amount of money. A wicker basket of the size of a small steamer trunk will do. Have a water and dust-tight cover of rubber made to fit it snugly with leather mounting on the corners. Arrange straps on the inside of the lid to hold several plates, forks, knives, cups, saucers, etc., together with the necessary cooking utensils for making meals readily and conveniently. All such utensils should be of aluminium. A moderate supply of spices and groceries may be packed in a wooden box so as not to be mixed up with the other contents. If the tour is through a hunting or fishing region, the chauffeurs ought to be able to supply their own "table" by some skill with the rod and the gun. In fact, this would give a genuine zest to the entire undertaking, and afford the intrepid sportsman a solid feeling of having gone to the bottom in the matter. If the tour is through populated country districts, most of the camping is likely to be done in village inns, while the cooking, in such a case, would be intrusted to the innkeeper's "chef." To make an automobile camping trip a success you must choose an out-of-the-way route that will compel you to camp out and "do" yourself.

Something that is almost always invariably overlooked in making up an outfit is a supply of drugs, medicines and plasters. Accidents are liable to happen in a hundred unthought-of ways, and sometimes minor bruises and scars from slipping or falling become quite annoying from not being attended to promptly. A man not accustomed to use his hands for manual labor is practically doomed to hurt himself more or less during a long-distance trip involving the going into camp nightly.

A canvas folder with pockets for various-size bottles, boxes and rolls, containing drugs and medicines, would in the majority of cases be found to be of practical use.

The personal effects of two passengers could easily be packed in two portmanteaus, as all that is needed, besides the clothes they are continually wearing, is changes of underwear and stockings, handkerchiefs, extra pair of shoes, and such little extra items as the taste of the chauffeur may fancy and the season of the year may require. The point should be to take along as little as possible and yet be comfortably fitted out.

Having followed this outline in the main the intending auto tourist should take special care in packing his outfit. Careless packing will make the most ingeniously chosen outfit sound like a barrel of tin cans. Everything needed can be packed in three pieces. First, the rubber-covered basket. Pack the rubber mattress, tenting, and the blankets in that to prevent rattling of the eating and cooking utensils. Second, the portmanteaus with clothing, medicine, etc. Third, a canvas-incased rod and gun strapped together, and put in a cylindrical leather case with rubber covering.

AUTOMOBILE NOTES.

A motor exhibition will be held in Copenhagen from April 11 to 27 next.

Italy's King has passed an examination before the Commissioners of Police and has been granted a license to operate his vehicle within the limits of the Eternal City.

It is said that Fournier, the celebrated French chauffeur, received $50,000 for the use of his name alone, without services, in the recent incorporation of an American company bearing his name.

Entries for the international blue ribbon event of the year will this year be confined to English and French machines. Several American firms had expressed an intention of entering vehicles but failed to do so.

The Automobile Club of America will inaugurate the next summer's campaign with a 100-mile endurance run and mile and kilometer time trials. No date has as yet been set for the "carnival," which will consume two days.

An honest enemy has at least the respect of his adversary. San Francisco boasts of an association of stable and carriage owners, and at a recent meeting the members came out flat-footed with a resolution to the City Council asking that body to forbid the use of the public parks to self-propelled vehicles!

An evidence of the growth of the automobile industry in this country may be had from the statement that the repair and disposition of second-hand vehicles has become a most important part of the business of every dealer. As was the case in the palmy days of the bicycle, wealthy automobile operators "trade in" their old machines each year for new ones of the latest pattern.

Those in charge of Cleveland's parks have no nonsensical notions regarding self-propelled vehicles. The privilege of operating lines of public conveyances therein is let out annually to the highest bidder, and the powers that be have intimated that they would prefer to have automobile service.

American automobilists entering Canada from the United States in their own vehicles may now do so duty free. The regular duty of 25 per cent is still assessed as usual when crossing the boundary line, but it is returned if the vehicle recrosses the frontier within six months. A full description of the machine, together with a statement of the probable time it will remain in the country, must, however, be filed with the customs authorities.

An automobile tire of the single-tube pneumatic type that is meeting with much favor has the tread "armored" with vulcanized rubber. This armor is in four parts, its central portion being supported by a core of pure rubber, side pieces of slightly vulcanized rubber supporting the core, the whole being incased in an outer covering of tough, thoroughly vulcanized rubber. The feature of this tire is that, despite the fact that it is practically non-puncturable, it still retains all the resiliency of an unarmored tire.

An interesting instance of the application of the automobile principle to commercial uses is given in the outfit recently furnished by the Electric Vehicle Company, of Brooklyn, N. Y., to the Hall Safe Company, of the same city. A heavy truck supplied with three motors—two of which drive the rear wheels, the third used for hoisting safes—makes possible a great saving of time and labor in the work of installing heavy receptacles for valuables. A comparison of the utility of the new scheme with the former plan of installation shows that in placing a 4-ton safe on the seventh floor of a building but three men are required as against eight, and but 6½ minutes are necessary as against 2½ hours.

A punctured tire is rendered a practically negligible quantity by the combination pneumo-cushion tire of F. W. Skinner, of Valley Falls, R. I. A transverse section of this tire shows an inner air chamber taking up about half the space within the tube, the outer or tread portion having its inner face (resting on the covering of the air chamber) shaped like an arch, the center of this arch being hollow. This and the space on either side of the crown of the arch form a cushion which protects the inner pneumatic section from puncture unless the penetrating object be quite long and the angle direct. This combination of the pneumatic and cushion principles is said to possess all the resiliency of the average pneumatic tire designed for heavy automobile use.

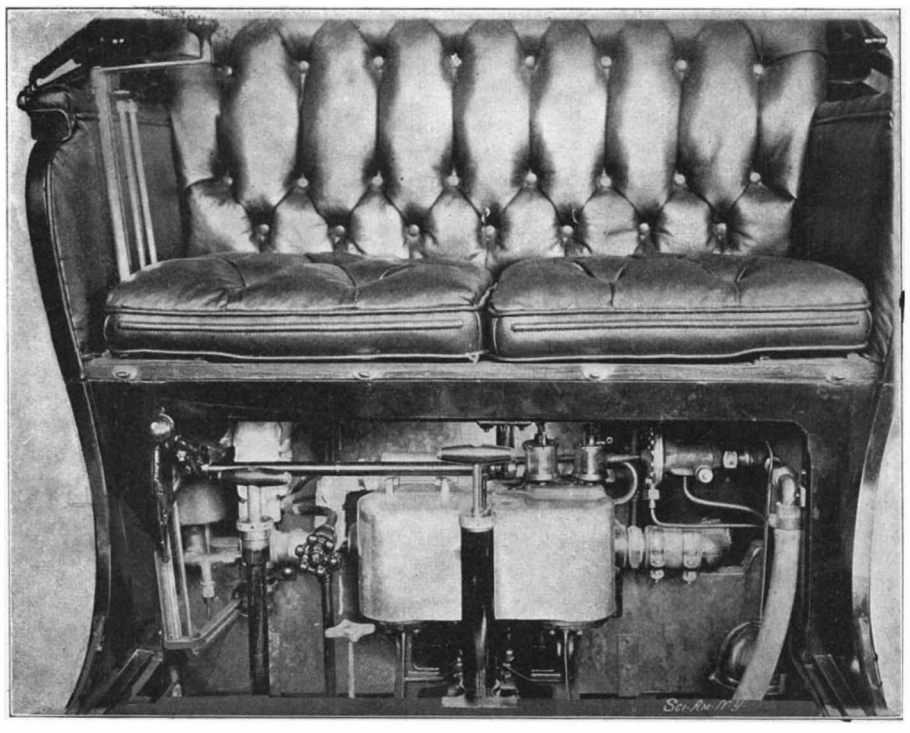
One of the inconveniences connected with the operation of a gasoline vehicle is the necessity of starting the motor from the outside by means of a crank. Among the various devices to obviate this, that of Walter Mitchell is not the least meritorious. Keyed on the motor shaft is a hub having a ratchet face that can engage with corresponding teeth on the hub of a disk that supports a spiral spring. This hub and disk are free to turn on another hub extending into it from the right and having at its right side a face that is adapted to engage a friction clutch keyed to the shaft. The engaging of the friction disk with its corresponding male member, and moving the spring disk and the teeth on its left and longitudinally on the shaft are done by means of a clutch lever. Longitudinal separation of the hubs of the two disks is provided against by a pin or pins in the one engaging an annular groove in the other—the two disks being thus left free to revolve independently. One end of the spiral spring is fastened near the periphery of the spring disk and the other (inner) end to the hub of the clutch disk. On the peripheries of both the spring and clutch disks are ratchets which are engaged by spring pawls connected with the clutch lever. When the clutch disk is revolved by contact with the friction clutch it coils up with the spring, the spring disk being held stationary by engagement of the ratchets with the spring pawls, whose outer ends are immovably connected with the vehicle frame. When fully wound up the friction clutch is disengaged and the spring pawl prevents reverse rotation of the clutch disk. The parts remain in this position in readiness for use. When it is desired to start the engine the clutch lever is moved to cause the toothed ratchet on the hub of the spring disk to engage the ratchet on the hub that is keyed to the shaft. This hub has an inclined face that causes an arm on the spring disk to release the pawl that holds this disk against revolving. The release of this permits the coiled spring to act directly on the shaft and to throw the engine over, compressing the charge, until one or two charges have been exploded, when the engine is in operation.

Steam Carriages

THE WHITE STEAM CARRIAGE.

The 1902 model of this now famous steam carriage, together with some details of the principal parts of its mechanism, are shown in the annexed illustrations. Prior to the New York-Rochester endurance contest of last September the White Sewing Machine Company's carriage was almost unknown to the automobiling public, but when four of this company's machines successfully accomplished that difficult journey and returned with first-class certificates, interest in this machine was aroused. Its construction today remains the same as when it made this record,

THE WHITE STEAM CARRIAGE.



THE MECHANISM OF THE WHITE STEAM CARRIAGE.

which speaks well for the work of those who planned and built it.

The heart of all steam machines is the boiler; and the White differs from all other steam carriages principally in the construction of its boiler. This is in reality not a boiler, but a series of superposed generating coils, twelve in number, with the outer end of each coil rising to the top of the stack and there being connected to the inner end of the next lower coil. The outer end of the bottom coil passes straight across over the burner before rising to the top of the generator, and in this straight section of pipe is situated a thermostat for regulating the fuel supply to the burner. The four bottom coils are made of steel tubing, while all the others are of copper. The total length of tubing in the generator is 216 feet, and the total heating surface 30 square feet.

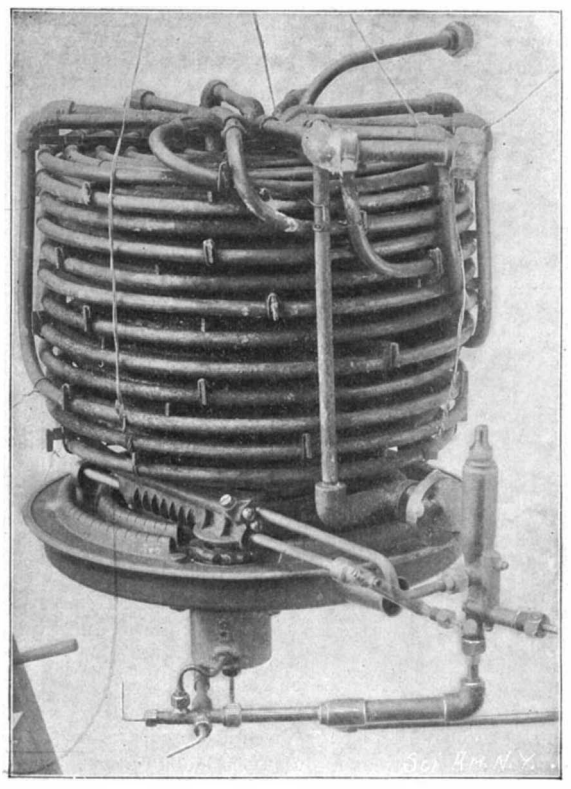
From the manner in which the generating coils are connected it will be seen that water must be forced into them, as it will not of its own accord gravitate from one to the other on account of the connection of each coil rising to the top. The water is pumped into the coils at the start by the hand pump shown at the left in Fig. 1, after which the machine is ready to fire up.

In order to start the fire the needle valve of pipe, *B*, Fig. 1, is opened, thus allowing gasoline to flow into the trough, *C*, and saturate absorbent material contained therein. This gasoline is lighted and allowed to burn itself out. In about a minute it heats the conical vaporizing chamber, *H*, sufficiently to vaporize gasoline for the pilot light. This fluid is then turned on at the valve, *D*, and allowed to pass through the pipe, *E*, to the vaporizing chamber, from which it makes its exit by the pipe, *F*, and issues from the needle valve, *G*, in a jet, which is ignited by the burning gasoline in the trough. Once the pilot light is started it is a matter of but a couple of minutes to heat the main vaporizing coil, *J*, when the main feed valve, *N*, may be opened and the gas let into the burner, whence it issues through narrow transverse slits in the circular coils shown in cross-section in Fig. 1. The needle valve, *N*, controlling the admission of gas to the burner, can also be operated from the seat by turning the wheel of the middle spindle that projects upward at the side.

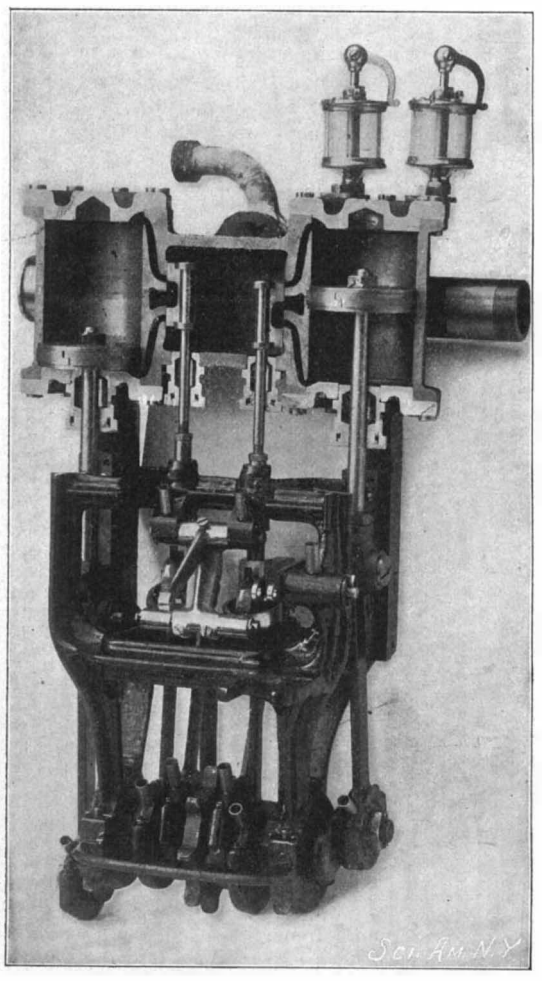
Shortly after the burner is lighted the steam pressure will show in the gage and will be seen to rise rapidly. The fire is then checked by turning the needle valve slightly, as the thermostatic regulator does not operate till the steam has had a chance to become superheated. It is not known definitely where the water flashes into steam, but this happens probably in the third or fourth coil from the bottom, and the other coils are merely superheaters. The temperature obtained in these is said to reach 800 deg. F.

The carriage is now ready for operation. The burner valve is opened further again and the steam pressure allowed to run up. If the throttle is then opened, the pressure will be seen to fall back to about 100 pounds, but to recover quickly its normal working point. From now on this pressure will be kept down by the thermostatic regulator, which acts to shut off the fire if the temperature of the superheated steam rises above a certain point, or, in other words, if the flame supplies too much heat and generates steam too rapidly. The regulator is shown in cross-section in Fig. 2, and may be described in but a few words. It is placed in the straight steam pipe, *E*, that passes across the generator below its lowest coil, and consists of an outer tube of expansible metal such as brass or copper inclosing and having fastened to one end a rod, *A*, of non-expansible metal like steel, suitably connected with a bell-crank, *B*, by means of which it can raise or lower the feed valve, *C*. A rise of temperature causes the tube inclosing rod, *A*, to expand and carry *A* to the left, which results in lowering the horizontal arm of bell-crank, *B*, thus closing the needle valve, *C*, and shutting off the fire. This method of fuel regulation by a thermostat is peculiar to the White carriage, as in all other steam machines the boiler pressure is used to operate the needle valve. In the case of the White generator, however, the fluctuations in pressure are so sudden and rapid that a pressure regulator on the fire would make too great fluctuations of the latter, so the thermostatic regulation was doubtless chosen because it would operate more slowly and gradually.

There is only one more important feature in the description of this generating system, and that is the feed water control. The water is forced by a small pump connected to the crosshead of the engine through the hose seen at the right of the view of the mechanism, directly into the top coil. The feed water regulator branches off from this pipe as it passes back to the generator and can be plainly seen in the illustration. Referring to the diagrammatic view of this regulator shown in Fig. 3, *J* represents the main feed pipe, and *K* a bypass to pipe, *L*, which leads into the tank. *C* is the



THE WHITE TUBULAR STEAM GENERATOR.



CROSS SECTION OF THE WHITE STEAM ENGINE.

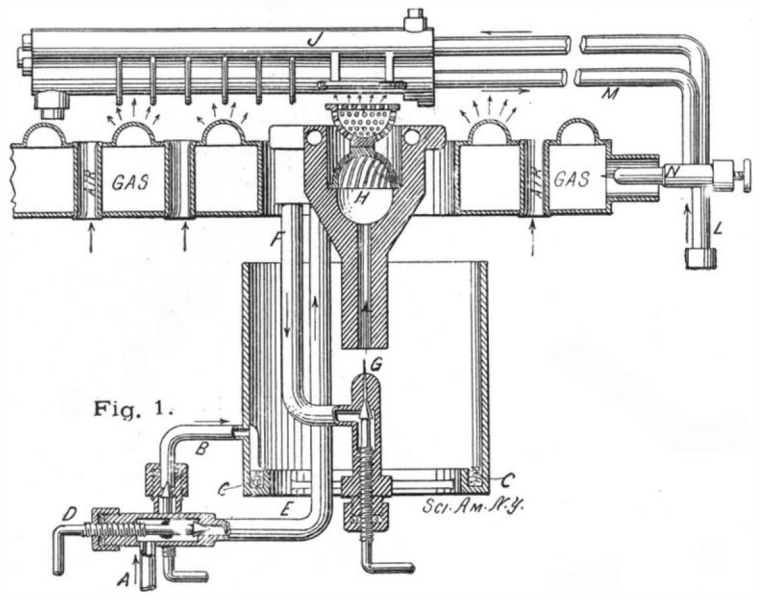
by-pass valve connected by its triangular spindle, *B*, with the plug, *A*, that abuts against a pressure diaphragm, *H*, and is backed by a stiff spring, *D*. The tension on *D* may be varied by means of the worm, *G*, which turns small gear, *F*, and since *F* is threaded on plug, *E*, and *E* held from turning by a pin set in a groove running lengthwise on its surface, *E* is made to advance and compress *D* till it gives the proper pressure. This adjustment, when once made, never has to be altered. The spring is generally set for 210 pounds' pressure.

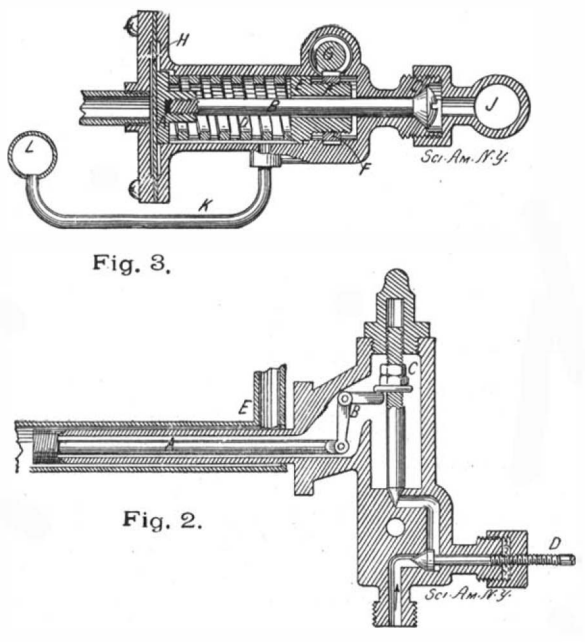
The operation of the regulator is very simple. When too much water is being pumped into the generating coils the steam pressure rises and, overcoming the spring, *D*, in the regulator, forces open the by-pass valve, *C*. The water is then sent back to the main suction pipe, *L*, instead of being forced into the generator, while a check valve in the supply pipe to the latter between it and the by-pass branch holds the steam pressure and keeps it from escaping through the by-pass to the tank. Thus no water is sent into

the coils till the pressure falls again, when the by-pass immediately closes and allows it to be pumped in. The size of the stream of water that is regularly thrown by the pump may be judged from the fact that the by-pass valve is only ⅜ of an inch in diameter and opens but about 1-64 of an inch. If the carriage is being run very slowly in a crowded street the pressure will sometimes fall as low as 100 or 75 pounds, and this will have to be raised by gradually speeding up the machine, when more water will be pumped into the generator and the pressure will slowly rise. One always has the alternative of a few strokes of the hand pump in such a case also, but by careful operating this will scarcely ever have to be used. Should all the water in the coils become evaporated from any cause, no harm would be done to the coils, and the only result would be that the thermostat would shut off the fire. The generator is equipped with a safety valve set to blow off at 500 pounds, but ordinarily the thermostatic regulator will shut off the fire before the pressure reaches this point. In a ride which one of the SCIENTIFIC AMERICAN staff took recently up Riverside Drive to Grant's Tomb in one of the identical machines used in the endurance test of last September, the steam pressure at no time rose above 450 pounds or fell below 100, even in ascending some of the steep pitches when going east from Riverside and on West End Avenue. The air pressure in the gasoline tank had to be raised once by forty-five strokes of the air pump, and the engine cylinders oiled a couple of times by a stroke or two of the oiler (the third rod on left side of seat) in the run of an hour and a half. Otherwise the carriage needed no attention. The pressure was maintained on an average at between 200 and 250 pounds, and would only rise to 450 when coasting or fall to 100 when heavy demands were made for steam.

A description of the White carriage would not be complete without a few words about the engine, a fine cross-sectional view of which will be had from the illustration. The engine is of the usual double-acting slide-valve type, the slides being oiled by two oil cups on top of the cylinders, which are 3 inches bore by 3½ stroke. It has a ball-bearing crankshaft and is mounted on trunnions so that the lower end can be swung forward to tighten the chain. The cut-off and reverse are operated by the lever moving over the notched segment on left side of body below the seat, which is joined by a horizontal rod to another lever suitably connected direct to the links of the engine. The throttle is of the gridiron type and is operated by the small crank on top of foremost spindle on left hand side of seat.

The above description will be found to give a good idea of the principal parts of the White mechanism, and it is easy to see that simplicity was the chief quality aimed at in designing the machine. This has not been attained by supplementing the usual water-tube boiler with numerous safety devices, but rather by making a radical departure from the old, well-established methods of steam generation, which have been supplanted by a safer generator of a new type. Let us hope that the next step toward the improvement of steam carriages will soon be taken, namely, the employment of some form of solid fuel in place of volatile gasoline. Then this universal power will become as safe as it is useful for propelling the business and pleasure vehicles of the world.





DETAILS OF THE WHITE STEAM CARRIAGE.

Wear of Roads by Automobiles.

The influence of automobiles upon the public roads is a question that is likely to become prominent before long, especially where, as in France, the use of heavy vehicles for passenger and baggage transportation is on the increase. According to the Bulletin of the Société des Ingenieurs Civils, the local councils throughout the country have been occupied lately with the application of automobiles for passenger and freight service, and in some cases such systems are already in running order. Some examples are given which show the condition of affairs. According to the report of a special committee to the General Council of Vienne (south of France) it is shown that at that period, which is some time ago, as many as 14 departments had commenced to study the question, but had not begun to organize a service; 4 others had made rather unsuccessful attempts, and 9 others had commenced operations, but the data were too recent to draw a conclusion. They were almost unanimous upon one point, namely, that the roads in their present state are not in a condition to support the excess of wear which will result from the new mode of traffic, and that they must be reinforced and enlarged. This will necessarily lead to an increased cost of maintenance, and this increase is estimated (by two departments) at $70 per mile, and thus it appears that the extension of the automobile service will bring about a considerable increase in the charges for the public roads. The report presented to the General Council of Charente gives some useful figures in this connection. The national and departmental routes and those of general communication in this department can well support loads of 18,000 pounds at a speed of 2½ miles an hour; if the speed of traction is increased under the present conditions the wear will increase in proportion, and for a road of given resistance the load must be correspondingly reduced. The engineers of the Charente Department estimate that if the speed is increased to 9 miles an hour the load should be reduced to 6,000 pounds per axle; two other departments give for the same case 5,000 and 4,800 pounds. It is the general opinion that the wear upon the road caused by transporting a given load increases with the speed of transport, and if it is admitted that the automobiles are to travel at higher speeds than in the case of animal traction, it will be necessary, in order to avoid spoiling the roads altogether, to give them increased resistance and also to dispose the automobiles so that the wear will be reduced to a minimum. As to the first point, the Board of Engineers estimates that it would cost from $600 to $3,000 per mile to transform the roads so as to enable them to resist the wear caused by the heavy automobiles. As to changing the automobiles, nothing definite has as yet been established, but it is considered that according to the experiments of Gen. Morin it will be best to discard the narrow tires in all cases and use tires sufficiently wide to diminish the wear. Experiments have also shown the superiority of wheels of large diameter over the smaller wheels, and the future regulations for automobile service should encourage the use of automobiles with large wheels.

THE STEARNS STEAM STATION WAGON.

This steam carriage is constructed on the lines of the popular Brockways, commonly known as station wagons. It has a seating capacity of four passengers. The wagon is constructed so as to protect the passengers in unpleasant weather; side and back curtains, glass panels in the doors and a glass panel front being part of the equipment. The front portion of the carriage is upholstered in leather; the rear seat and inside of wagon is upholstered in green broadcloth, making a decidedly handsome job. The gasoline tanks hold 14 gallons of fuel, sufficient for a run of 125 miles. Water tank capacity, 35 miles. The engine used in this carriage is an 8 horse power, simple slide valve engine with a Stevenson link motion. The carriage also has a boiler of ample capacity. The running gear is constructed on the same general lines as used in the regular Stearns carriages, tubular front and rear frames and hickory sidebars. The wheels are of tubular steel, fitted with 3-inch pneumatic tires. This carriage is attractive in appearance and is most serviceable for station and family use.

THE STEARNS STEAM STATION WAGON.

Novel Automobile Passenger Service.

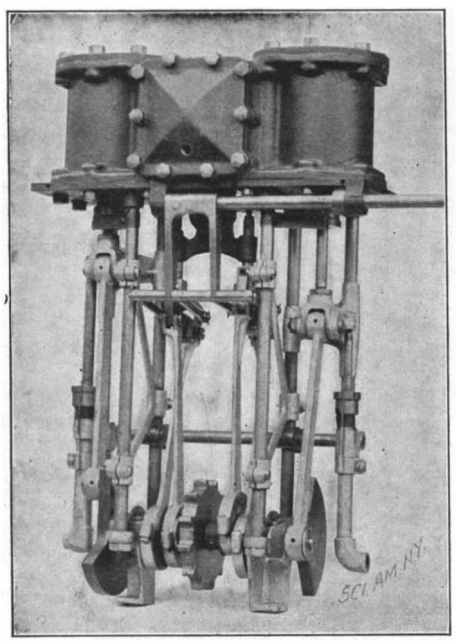
An automobile service has been recently inaugurated in the city of Hamilton, Ohio. Three omnibuses, with a capacity of twenty passengers each, are in operation running through the city and making connection with the line of the Mill Creek Electric Railway Company, which corporation has never been able to secure permission to enter the city with tracks. The latter line operates between Hamilton and Cincinnati, and it was compelled to put the automobiles in operation in order to accommodate its patrons between these two points.

THE LANE STEAM CARRIAGE.

The New York-Buffalo endurance contest brought to light a steam carriage, the performance of which was in every way so remarkable that many a chauffeur wondered why he had never heard of the vehicle before. The carriage in question was made by the Lane Motor Vehicle Company, of Poughkeepsie, N. Y., and finished the run without any adjustment of the parts and without any injury with the exception of that sustained by one tire. It was the only carriage entered by the firm. Limited as the amount of space at our disposal is, it is impossible to devote as long a description to this carriage as might be desired. Nevertheless, there are several parts so distinctly novel in construction that they must be more or less fully described.

Doubtless the most vital part of every automobile is its motor. The Lane engine presents some peculiarities, prominent among which is a frame, made up of straight rods suitably braced. Two of the rods constitute the slides and are surrounded by the cross-heads. The engine is mounted at approximately an angle of forty-five degrees to the axis of the vehicle's body. This arrangement is certainly meritorious, for the vibration is transmitted at an angle to the vehicle-frame. The crank-shaft is a solid piece of steel from end to end, and with it the sprocket, eccentrics, cranks, and counterbalances are eccentrically formed. Instead of balls, hardened interchangeable bushings are employed for the bearings. All parts below the cylinders are inclosed in a splash-tight copper case. In accordance with the best modern practice lubrication is effected automatically. Even the cylinders are mechanically oiled, for sufficient lubricant enters with the piston-rods.

So far as the steam-generating apparatus is concerned, particular attention should be called to the burner. The vapor tubes are arranged in parallel series and are provided each with a single row of apertures



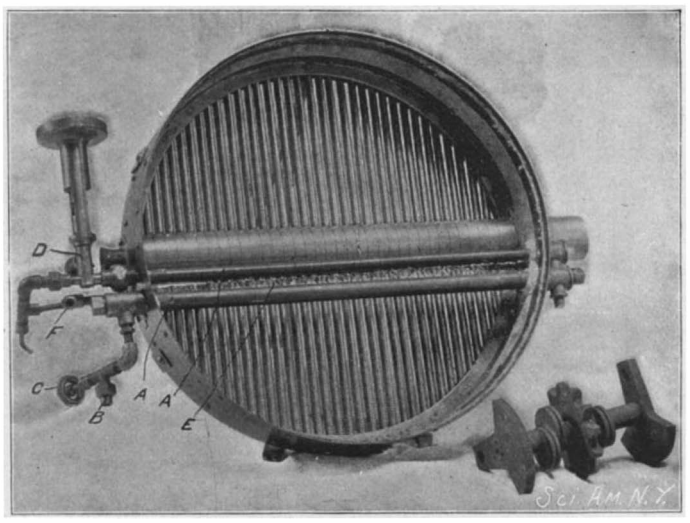
THE LANE STEAM ENGINE.

for the issuing gas. Extending entirely across the burner above the apertured tubes is a mixer-tube. The air rising from below is brought into contact with each side of each flame and is caught by the flames on either side. The upward pressure or force of injection in the combustion-chamber is greater than in the ordinary types of burners. The combustion is odorless. The igniting and vaporizing device is worthy of particular attention. The vaporizing tubes, *AA*, are connected with a liquid-fuel supply pipe, *B*, provided with a hand-operated valve, *C*, for starting ignition, and with a regulator, *D*, which is automatically controlled by the boiler pressure, so that the consumption of fuel is nicely adjusted to the amount of steam generated. In order to heat the tubes sufficiently to start vaporization, an asbestos torch, *E*, is used, which receives a supply of wood alcohol from a cup connected by a pipe, *F*, with the torch. When the pressure in the boiler rises above a predetermined point, the fuel-regulator, *D*, cuts off the supply immediately. A blue flame pilot light within the combustion-chamber and directly below the vaporizers burns continuously independently of the main burner. With an eye to the possible necessity of making repairs the vaporizing tubes are made straight and are fitted with removable end plugs without the casing. The unfastening of a few screws permits the removal of the grate without interfering with the piping, and also of the vaporizers, torch, pilot light, and the entire burner case if necessary.

It has been found a questionable practice time and time again to leave the regulation of the water supply entirely to the mechanism itself. In the Lane steam carriage, the operator is, therefore, expected to control the water supply to the boiler. Nevertheless, a simple safeguard has been provided which renders it quite impossible for him to carry the water higher than the maximum level, and which prevents the water from sinking too low. Connected with the boiler at a definite point is a pipe carried forward and connected with a steam-gage. Back of the steam-gage is a transverse pipe discharging into the live-steam pipe between the throttle-valve and the boiler. Should the water rise to the opening of the first-named pipe, it will flow to the steam-gage, thence by the transverse pipe to the live-steam pipe, and thence through the cylinders of the engine. The exhaust-pipes carry the water back to the water tank. This simple method of maintaining a constant level has been found in practice to be extremely efficient. It is not necessary to renew a broken waterglass on the road; the pump is simply turned on, and the operator continues his journey.

In most motor vehicles, air is supplied by a hand-pump, with the result that the pressure over the fuel supply constantly decreases, and the fuel is supplied to the boiler at a gradually diminishing pressure. Hence it has been a matter of unusual difficulty to supply fuel to the burner in constant quantities. In the Lane carriage the pump and the engine are inclosed in a common casing. The piston of the air-pump is rigidly connected with the piston of the engine. Hence it follows that the pump and engine pistons have a corresponding movement, so that the amount of air supplied is absolutely dependent upon the work performed by the engine. Outside of the engine casing is a regulating valve for the air-pump. A regulating screw, likewise without the casing, is provided, in order to vary the air pressure. The screw in question merely increases or decreases the clearance space between the valves and thus regulates the pressure to a nicety. The device relieves the operator of all the necessity of hand pumping.

The feed-water for the boiler is heated by the exhaust steam from the engine, and whatever exhaust steam is not thus condensed is wholly or partially absorbed by the products of combustion. A pipe connected with the exhaust of the engine is carried under the body of the vehicle, and discharges directly into the water tank. The moisture contained in the steam is absorbed in a considerable measure by the gases. As a consequence the mingled body of exhaust steam and gases discharged will be quite invisible. The flues through which the products of combustion from the burner pass are arranged in a peculiar manner. A horizontal flue over the boiler communicates with an upper and a lower downwardly-discharging flue. When the vehicle is at rest the products of combustion are carried through the upper downwardly-conducted flue; when the vehicle is in motion and aided by the injector action of the exhaust steam, the products pass through the lowermost downwardly-extending flue. All the products



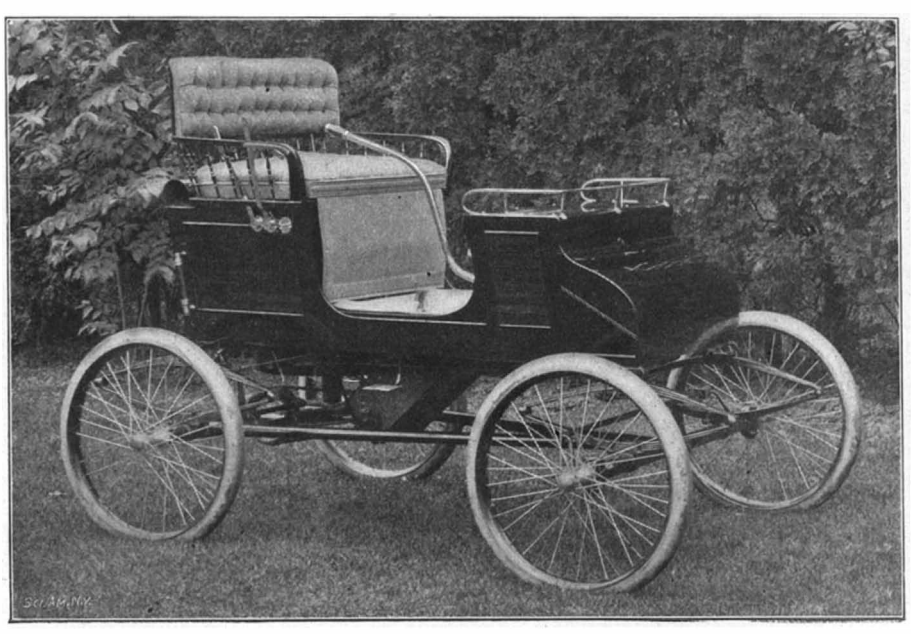
THE LANE BURNER AND CRANKSHAFT.

of combustion are thus caused to traverse a downward path when passing from the horizontal flue over the boiler. By reason of this downward trend of the flues, the products of combustion will not be picked up by moving air currents and driven directly upon the occupants of the vehicle.

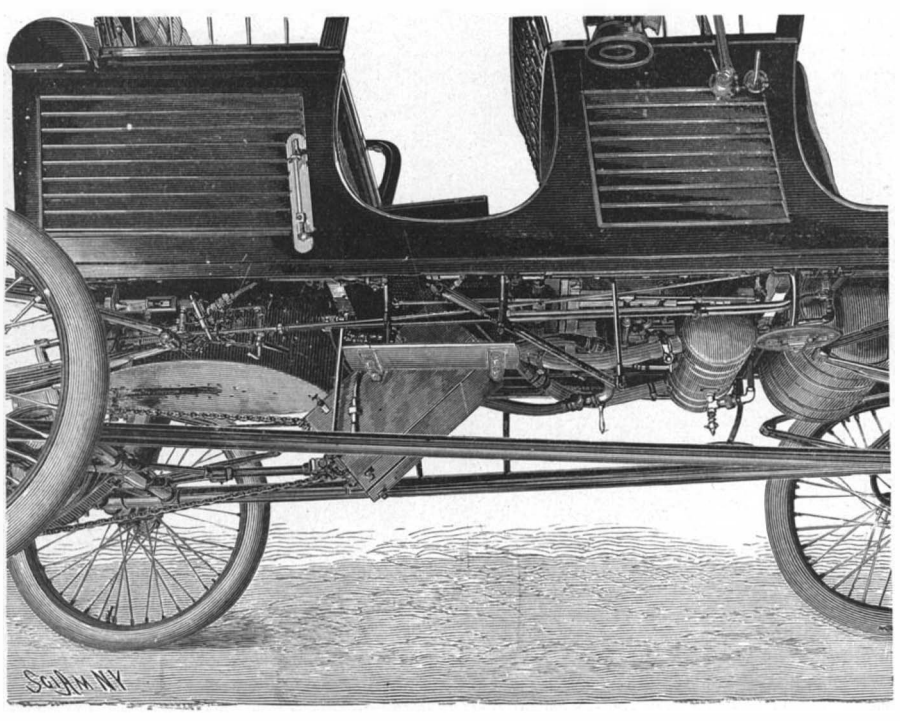
Much could be written upon the structural novelties embodied in the running gear of the vehicle, as well as in the minor portions. There is, perhaps, not a single part of the carriage that does not, in some way, show an improvement upon previous constructions.

The demand for a strong, light and comfortable machine is growing everywhere, even in France, where the business has been given almost entirely to the construction of racers. In a recent report Thornwell Haynes, United States consul at Rouen, says that it has been estimated that the automobile industry of France supports more people, directly and indirectly, than any other industry. All the factories have tripled their product in the last three years, and all the establishments formerly given to the manufacture of bicycles are now engaged in building automobiles. It has been but a short time since all the factories were centered in Paris, but now there are large establishments at Rouen, Lyons, Bordeaux, Marseilles, Lille, St. Etienne, and Nantes. Mr. Leon Auscher in one of the Paris journals, recently enumerated a large number of trades and industries which have been materially benefited by the automobile boom, and says that at least 200,000 persons in France are maintained by that industry.

A Brooklyn (N. Y.) genius has secured a patent for a curious device for creating energy by feeding a tape of explosive caps into a chamber where they are successively exploded by a mechanically-driven hammer. The resulting gas from each explosion passes into a pressure storage chamber, whence it is drawn into an engine in a manner similar to that in which steam is taken from a boiler into a steam engine.



THE LANE STEAM CARRIAGE.



BOTTOM VIEW OF A LANE SURREY.

THE OVERMAN STEAM AUTOMOBILE.

The steam carriage built by the Overman Automobile Company, of Chicopee Falls, Mass., might almost be called a Franco-American vehicle, since the mechanism has the complexity of detail of the French machines, while the Yankee ingenuity of the New Englander is seen in the invention and method of assembling the parts. The carriage has been thoroughly tested during the last year; and many of the parts are now built stronger than heretofore, while the machine as a whole weighs more than last year's model.

The manufacturers of this automobile have incased its machinery as far as possible in a pressed steel body, which has the obvious advantage of being indestructible by fire. The side panels of the body below the seat can be opened, and the seat itself raised, thus allowing the machinery to be easily reached when necessary.

The principal points of interest in this carriage, which distinguish it from most other steam machines, are the automatic water feed regulator and various other similar devices, such as steam, water and air pumps, fusible plugs for putting out the fire in case of low water in the boiler, etc.

The water feed of the boiler is controlled by a thermostat, the construction and operation of which is shown. A U-shaped brass pipe, *B*, is connected at the upper end to the steam space of the boiler and at the lower end to the water space, so that the upper half is normally filled with steam and the lower half with water. This water is kept cool by a jacket, *C*, through which the feed water from the tank is pumped before going to the feed-water heater. On each side of the upper part of *B* are guide plates, *A*, in the ends of which the rod, *R*, is mounted. This rod runs forward along the side of the carriage and carries a finger, *F*, adapted to raise or lower the by-pass valve, *P*. *D* is a tongue soldered to the tube, *B*, at its upper bend and acting on *R* through the arm, *E*. When the water level rises in the boiler, the cool water enters the upper part of *B* and causes it to contract. This contraction is sufficient, when multiplied a few times by the lever arrangements, to open the bypass valve, *P*, and allow the water to be pumped back into the tank. In like manner, when the level falls, the bypass valve is closed.

The pump used to supply the boiler differs from those usually employed in that it is of the double-acting, slow-running type, and is driven by the back axle instead of by the engine. A small gear on the axle drives a larger gear that carries a crank pin. Fastened to the crank pin is one end of a long rod, the other end of which is attached to the pump. By the rotation of the gear carrying the crank pin, the rod and pump are given the necessary reciprocal movement. The water is heated before entering the boiler by passing through a 48-foot coil of copper tubing inclosed in a shell through which the engine exhausts.

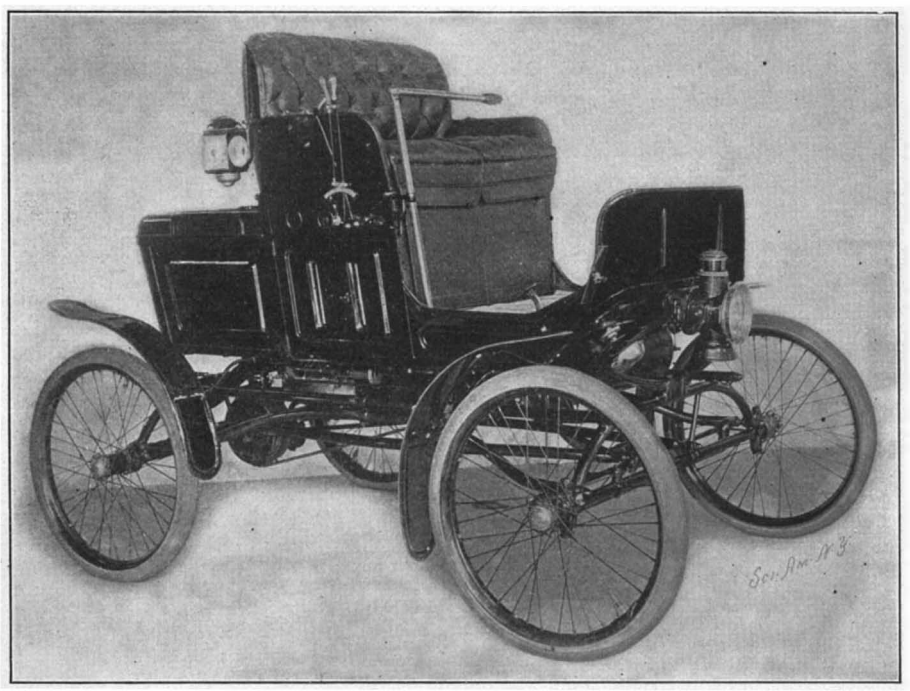
An injector is conveniently placed for filling the water tank when on the road. With the tank full of water, valves may be opened, and the water allowed to run into the boiler to the proper level, should the latter be empty and without steam. This is a very convenient way of getting water into the boiler.

The steam water and air pumps are started by turning a small lever beside the seat either forward or backward. The lever is on the end of a rod that runs across under the seat and carries a small eccentric at a point near the pumps. The eccentric raises or lowers a rocker arm, that serves to open the valve to either the air or water pump. Besides being thus under the control of the operator, the air pump is also furnished with a pressure diaphragm regulator which starts and stops it automatically should the pressure in the fuel tank fall four pounds.

The boiler and burner are of the usual type. The latter is started by burning some wood alcohol in a trough that runs across it beneath the main vaporizing tube. The alcohol is introduced through a funnel situated inside the panel below the driver's seat. The gasoline, before passing through the vaporizing tube, circles around the inside of the burner through a coil of pipe, where it is initially heated.

The burner flame is controlled by the usual pressure diaphragm, but there is also a flame accelerator that can be operated from the seat and by which the flame can be increased if more heat is needed, as in climbing a bad hill. The boiler is provided with a superheating coil which is situated in the combustion chamber directly over the flame.

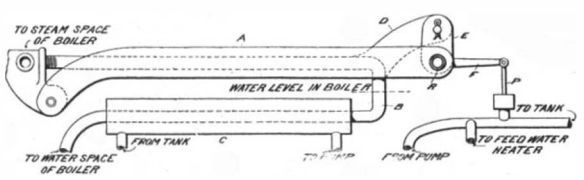
Should the water run low in the boiler, the steam will melt a fusible plug and close a valve, thus shutting off the gasoline and extinguishing the fire. This will happen while there is still two inches of water in the boiler, so that the chances are very slight of the machine ever being laid up from a burned-out boiler.



OVERMAN STEAM AUTOMOBILE.

The boiler has two water glasses also (one inside and one outside of the body), so that the water level can always be ascertained. Should either of the glasses get broken, back check valves immediately close and shut off the water and steam. A third glass indicates the water level in the tank.

The engine of the Overman carriage is of the piston-valve type, and has the cranks completely inclosed and running in oil. Plain bearings are used throughout. The cylinders are 2½-inch bore by 3-inch stroke. The engine is mounted on hollow trunnions which form admission and exhaust pipes respectively, and its lower end can be swung forward for tightening the chain. The exhaust from the engine is run into the tubing of the frame, whence it issues into the atmosphere through a series of small holes.



WATER-FEED CONTROLLER.

An auxiliary third gage shows the amount of gasoline in the tank. At night, by pressing a button, all three gages can be illuminated by a small electric light; and although the presence of the automatic feed water regulator renders inspection of the water glass unnecessary, this too can be instantly illuminated by pressing another button. It will thus be seen that this carriage is complete even to the minutest detail, and has all possible devices that are known at present for the comfort and convenience of the operator.

THE GROUT QUEEN STANHOPE.

The cut shows the latest production of Grout Brothers Automobile Company, Orange, Mass. The straight lines and curves appearing in this style are combined to make a most pleasing and well-proportioned carriage. Handsome top, mud-fenders, and attractive side lamps show that it is well equipped, with wide body and seat and standard wide tread.

Most important, however, are the motive parts; the yoke inclosed compensating gear is drop-forged; the engine is of heavier construction than usual. The eccentrics and sprockets are drop-forged in one piece, thereby replacing the thirteen separate parts heretofore required. All tanks are seamless, the brake double-acting. The gasoline tank has capacity of 7½ gallons; the 36-gallon water tank is fitted with an indicator. A steam ram fills water tank in five minutes, taking water at 40 degrees F., the operation raising it to 140 deg. The water passing then through heater is very nearly 212 deg. when finally it reaches boiler; thus it will be seen that the Grout vehicle is also economical in operation.

THE GROUT STEAM STANHOPE.

An interesting test of military automobiles has lately been carried out in Germany. The Daimler Company, of Cannstadt, had received an order from the government for a number of tractors, and when they were finished a party of officers and men undertook to pilot them from Cannstadt to Berlin over the road. There were eight of these tractors in all, and each could transport a net load of half a ton. Seven of them were operated by gasoline motors and the eighth had an alcohol motor. The party included a captain, two lieutenants and 34 under-officers, together with the soldiers of the testing department of the Berlin Transportation Board. They started out in good order and at first the weather was favorable, but soon after the temperature lowered and the routes became frozen. This made the journey very difficult and was at the same time a good test of the machines. The grades are steep in that region, and it was only with great difficulty that the tractors could be made to pass over the frozen roads. Besides, the conductors had not acquired the experience necessary to make the vehicles operate with entire satisfaction. The trouble caused by the slipping of the wheels was overcome by applying an ingenious idea. The wheels were provided with iron tires, and it occurred to some of the party to equip these with points in order to avoid slipping. This was accordingly done, and it was found to be a great improvement. The most difficult part of the trip was in going through the Thuringen Forest, where they encountered a driving snow which greatly impeded their progress. However, they were successful at last, and after a voyage full of incidents they were able to reach Berlin. The various difficulties which had to be overcome during the trip served to bring out the good qualities of the mechanism, and in fact the tractors showed good resistance throughout. Another series of tests of military automobiles is that which has been made recently in Italy, and the Etat Major are considering the question of adopting one or more types of automobiles for the army, these to be used by the officers and for the transport of loads. During the last grand maneuvers an omnibus was used to furnish the transportation service for the general commanding the division and his staff during twelve consecutive days. In spite of the bad weather and muddy roads the tests proved quite satisfactory. The omnibus used weighs 2,200 pounds and has a Bolide gasoline motor of 15 horse power.

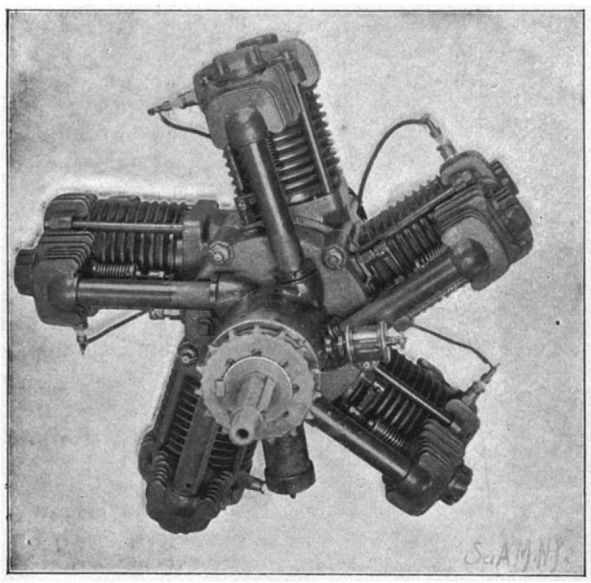
The German Emperor has offered a prize for a motor car suited for the purposes of the farmer. The award will be made some time next year by the Emperor himself.

Gasoline Automobiles

A NOVEL AIR-COOLED GASOLINE MOTOR.

There has recently been placed on exhibition in the shop of the Balzer Motor Company, of this city, an air-cooled gasoline motor of altogether new and original design which seems pretty certain of solving the problem of the light air-cooled motor for automobiles. It is about as close to a constant thrust rotary motor as any designer has come, yet it has only the simple parts of three or five ordinary high-speed motors.

The five-cylinder motor is shown in the two illustrations. One with three cylinders has been in use



THE BALZER REVOLVING CYLINDER AIR-COOLED GASOLINE MOTOR.

for a year on a carriage, and has been found to give good results and little or no trouble. The motor shown herewith weighs 300 pounds and develops 10 horse power at a speed of 500 revolutions per minute.

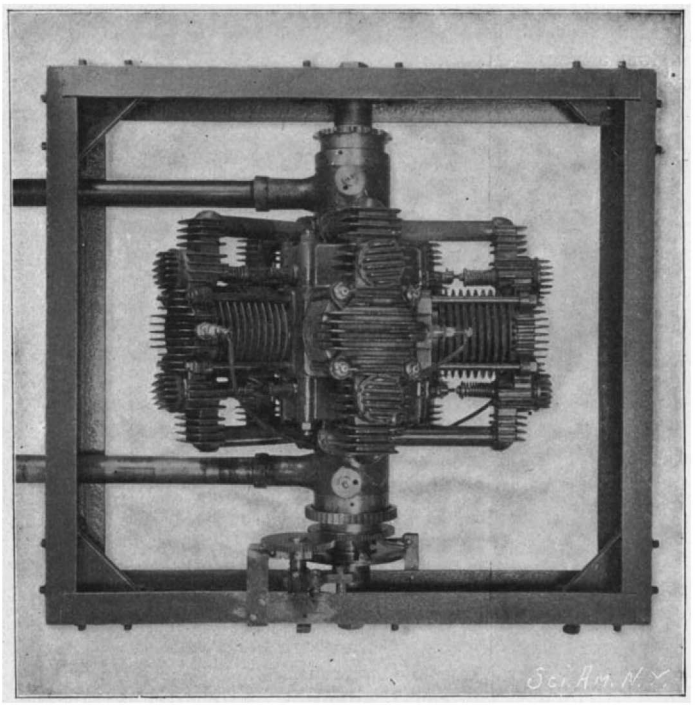
The Balzer motor differs from all others in having a stationary crank shaft and cylinders which rotate around it. The cylinders, instead of being perpendicular to the crank shaft, are set at a slight angle to it, as it has been found in practice that this arrangement gives better results. The cylinders are set in the center casting and fastened to it by four long bolts which also pass through lugs in the heads and hold them tight on the cylinders. This is a well-known method of assembling an air-cooled motor, and offers many advantages in the way of quickly taking the engine apart. Since the cylinders rotate in the Balzer motor, it is not necessary to get under the carriage to examine them, as any one may be brought around to the point where it is most easily inspected. Furthermore, the rotating cylinders act as a flywheel and thus do away with all the dead weight that forms so much of the total weight of the ordinary gasoline engine. Besides the momentum of the cylinders being thus made use of, the pistons are arranged to balance each other as much as possible, so that when one is on the working stroke the one opposite is compressing. This gives a practically perfect balanced motor, and one of great flexibility, giving a strong torque at widely varying speeds.

Referring to the plan view of the motor, the two large pipes seen running to it are the inlet and exhaust pipes respectively. They open into chambers in the base, and from these chambers individual inlet and exhaust pipes lead to the head of each separate cylinder. The charge is thus taken in on one side of the head and passes out on the other, and as both inlet and exhaust valves are mechanically operated, there can be no sticking of the inlet valves. Consequently, each cylinder is certain of receiving a full charge every time. The sparking plugs are now placed in the inlet chamber, just over the inlet valve, although in the illustrations they are shown in the center of the cylinder head. The position they are now in keeps them out of the path of any oil that works past the piston, as the inrushing charge of gas tends to keep the inlet chamber free from it, and, further, centrifugal force throws it into the highest part of the head. The oil is fed to the motor through the hollow crank shaft and drips upon the stationary crank. It is then thrown out into the various cylinders, and how thoroughly it lubricates them, as well as how efficient the cooling of the cylinder is, can be seen from the fact that when one of the cylinder heads was removed after the motor had been run half an hour in the presence of the SCIENTIFIC AMERICAN representative, about half a tablespoonful of oil was found on top of the piston in its natural state, and not all burned as it undoubtedly would have been in a stationary air, or, for that matter, water-cooled engine. An examination of the spark plug of the same cylinder showed it apparently clean and free from oil, thus demonstrating the action of centrifugal force and the inrushing gas in keeping the oil out of the firing chamber.

One of the most interesting features in connection with this motor is the method of producing the jump spark in the five cylinder heads. The arrangement is quite simple and, though daring in the extreme from an electrical standpoint, seems to work admirably. To start with, but one spark coil is used. This is a rather large-sized one of the Dow brand, fed by six cells of dry battery, and when one understands that it has to produce nearly 1,500 sparks a minute in order to fire the five cylinders (which explode alternately, giving five explosions every two revolutions) one sees that it must be a strongly built, well-insulated coil. The coil, however, is not the chief thing of interest in the sparking arrangements, but the method of switching the secondary current produced by it to the different cylinders. This is accomplished by a large fiber disk, into the surface of which are set five properly spaced brass plates. Each plate is connected, by rubber-covered flexible wire running along and through the motor casting, to a sparking plug. The disk and wires can be seen in the plan view of the motor. The make and break of the primary circuit is accomplished by a double cam acting on a spring with platinum points in the usual manner. The novel part of the arrangement is the switching of the secondary current. This has been tried by some foreign manufacturers, but the general practice is to have a separate coil for each cylinder and ground one end of the primary and secondary wires of each coil by a common wire to the engine. This method will be found described in the description of the new Panhard machines in the current number of the SUPPLEMENT.

As already stated, the motor can be readily dismounted and all the parts reached quickly. When the cylinder and head are removed the piston then exposed to view will be found of interesting construction. It has two wide heavy rings, over each of which are slipped four smaller rings. The latter are mismatched and pinned to the large rings, so the joints can never get in line. The connecting rods are fastened to the pistons by universal ball and socket joints, which leaves the pistons free to turn in the cylinders and thus wear evenly all around. The cams that operate the valves are geared so as to always travel ahead of the cylinder in order to open the valves at the proper time.

The Balzer motor has passed the experimental stage and will be found entirely practical. The company have built many different small, light-weight motors on this principle during the last five years, some of which show great ingenuity. In one, for instance, a mechanical igniter of the wipe spark type was included with the positively operated valves. It will thus be seen that the motor, although constructed on a novel principle, is not a recent invention, but is, in its present state, the perfected form of an invention itself half a decade old. It should, therefore, soon find its way into light, high-powered automobiles in place of fan-cooled and water-cooled motors, with their various complications.



THE BALZER REVOLVING AIR-COOLED MOTOR—PLAN VIEW.

THE KNOX TWO AND FOUR-PASSENGER CARRIAGE.

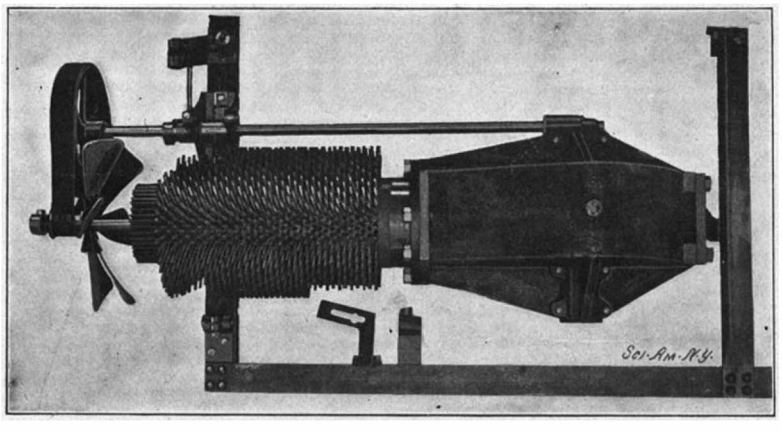
The illustration shows the combination two and four-passenger carriage of the Knox Automobile Company, of Springfield, Mass. It is their latest and most popular production, and was designed to supply the demand for a strong, powerful, simple, and neat-appearing single-seated vehicle which can be easily fixed to carry four persons by simply opening up the front seat. It also makes a very desirable touring car on account of its long wheel base, large carrying spaces, and its extremely easy riding due to its special spring construction. This vehicle has many desirable features, used exclusively by the company, and on which strong patents have been obtained.

One of the best features is the cooling of the engine by grooved pins and forced air system, which the company guarantees to give perfect results under all conditions, and which makes the Knox one of the few practical motor vehicles of its weight and power in the world that operate without water and get rid of the many nuisances connected with its use.

The long side springs with swiveled ends give the most flexible and easiest-riding vehicle possible over all conditions of roads, and as all the mechanism is mounted on these springs the wear and strain on it is very slight. The carriage is driven by a single horizontal cylinder, 8 horse power medium-speed gasoline engine, located in the front part of the body and so arranged that it may be got at from all sides for inspection. The valves open directly into the head of the cylinder. The compression is high, and in connection with the variable sparking arrangement the greatest power is obtained that is possible with this size cylinder, which is 5 inches diameter by 7 inches stroke. The company guarantees that it will run the vehicle at a speed of thirty miles an hour, climb a 12 per cent grade at twelve miles an hour, and a 30 per cent grade on the low speed.

Another feature is an emergency hand brake, operating on the rear axle and entirely independent of the two foot brakes. This brake will stop and hold the vehicle in either direction on the steepest hill. It is self-locking and is a great safeguard against accidents. There are large carrying spaces in both the front and rear of the body. Ten gallons of gasoline are carried, which is sufficient to run the vehicle two hundred miles. The vehicle can be backed by pressing a pedal with the foot, and the two forward speeds are obtained by moving the hand operating lever to the right or left.

The engine and mechanism is mounted on



THE KNOX FAN-COOLED MOTOR.

THE KNOX COMBINATION SURREY.

an angle steel frame, to which the body is also bolted, and from which it can be removed by taking out four bolts.

One of the vehicles was recently run from New York to Springfield without any difficulty at an average speed of fifteen miles an hour. The roads were very muddy, and two-thirds of the trip was made in a cold and driving rainstorm.

The wheel base is 5 feet 9 inches long, tread 54 inches, tires 30 by 3 inches on all four wheels; the rear axle is solid from hub to hub and made of nickel steel; the differential gear is in one of the rear hubs; heavy roller chain drive is employed; the mud guards are of leather, 10 inches broad; large ½-inch double ball-bearings are used on both front and rear axle; and the motor is equipped with variable jump spark ignition, employing eight cells of dry battery, four in use and four in reserve.

A little device has also been attached whereby the engine may be positively started by a quarter turn of the starting handle. The main seat is very broad and has a high, comfortable back with springs in both the cushion and back. The company is getting many orders for this new model, especially from men who have had a great deal of experience with all kinds of motor vehicles, and have placed their orders only after giving the machine many practical and difficult tests. The carriages are equipped with all the extras usually furnished, including mud guards, lamps, roller boot and odometer.

THE EMPEROR'S YACHT "METEOR III."

Among the many debts that Germany will owe to the present Emperor is that of his having practically introduced yachting, and established it as one of the national German sports. His present, most active interest in yachting may be said to date from the time of his purchase of the English cutter-yacht "Thistle" from the Glasgow syndicate which built her and sailed her unsuccessfully off Sandy Hook for the America Cup. The original "Meteor" was opposed by the Burgess sloop "Volunteer," and made about as poor a contest for the cup as any yacht that ever came over for it. Although not suited for championship honors, she was a beautifully constructed and stanch craft, and was sailed by the Emperor for many years in the earlier days of his yachting enthusiasm. His next yacht "Meteor II." was a composite steel and wood racing craft, which combined in herself the best features of "Britannia" and "Valkyrie III." She was very successful in her races and was an easy winner from everything she met on the other side of the water.

"Meteor III.," which was designed by Cary Smith & Barbey, of New York, is an improved and enlarged "Yampa"—the latter, a very successful schooner that was designed by Mr. Smith and spent a great deal of her time in European waters. The "Yampa" eventually passed into the hands of the German Emperor, and under the name of "Iduna" has figured largely in the foreign regattas. The Emperor was so well pleased with the "Iduna" that last fall he placed an order with these architects for the construction of a larger and faster yacht, which should embody the best features of the "Yampa," and have incorporated in her the valuable experience which they had gathered from the construction and performance of their later racing schooners "Amorita," "Elmina" and "Muriel."

The dimensions of "Meteor III." are as follows: Length over all, 161 feet; length on water-line, 120 feet; beam, 27 feet; draft, 15 feet; the least freeboard is 4 feet 6 inches; the taffrail is 6 feet 6 inches from the water-line, and the eagle at the figurehead is 11 feet from the water. The model differs not a little from the type for large, fast yachts which has been prevalent of late years. Thus, there is a slight hollow in the load water-line at the bow, and while the modeling of the hull shows the customary S section, the vessel is much fuller below the water-line and shows less of the flat floor than we have been used to in the later yachts, and compared with them she is a much more wholesome model. The line from the fore-foot to the stern-post is similar to those which characterize Mr. Cary Smith's designs, and the whole model is marked by the individuality which is seen in "Amorita" and the other racing schooners which have been so familiar in the races and annual cruises of the New York Yacht Club.

The frames and plating of the yacht are of steel; the former consisting of steel angles 2 by 3 inches; the keel is formed of a trough of steel, into which the lead ballast is run. In this respect she differs from the Herreshoff boats in which a lead bulb is cast separately and secured to the hull by bolting.

The accommodations of the yacht are, as would be expected from her great size, extremely commodious. Aft on the deck is a steel house from which a companion leads to a vestibule below, from which access is had aft to a ladies' cabin which extends the full width of the ship. From the vestibule a passageway leads forward, on the port side of which are staterooms for the use of the Emperor's staff, while on the starboard side of the passageway are the Emperor's private apartments; among these is a stateroom 13 feet square with a large bathroom adjoining. The main saloon, which is at the forward end of the passageway, is a splendid apartment 18 feet in length and extending the full 27 feet width of the yacht. It contains a piano, lounges, fireplace and a table which augurs well for the imperial hospitality, inasmuch as it will seat twenty-four persons. Just forward of the saloon is a kitchen 15 feet in length by 18 feet in width. On the port side of the kitchen are staterooms for the cooks and stewards. Forward of the kitchen is the crew's galley, a stateroom for the captain and one for the mate and boatswain. Then follows a steel bulkhead, beyond which is the forecastle for the crew, which contains twenty-four bunks.

In designing the sail plan the yacht has been given sufficient canvas to insure her combining the requirements of a comfortable cruiser with those of a fast racing yacht, her total sail plan being a little under 12,000 square feet, which is not so much as that carried by the "Columbia" by 1,000 feet, and is about 2,000 feet less than that carried by "Shamrock II."—but they, of course, were out-and-out racing craft. The mainmast, which is 21 inches in diameter, measures from deck to cap 89 feet. The main topmast is 60 feet over all; 17 feet of which are in the doublings, making the total height from deck to truck 132 feet. The main boom is 82 feet over all. The foremast, which is 20 inches in diameter, measures 84 feet from deck to cap. The foretopmast is 55 feet over all, with 16 feet in the doublings, the total height from deck to truck being 123 feet. The fore-boom is 36 feet in length. The base line measured from the end of the main boom to a point half-way between the jib stay and the jib topsail stay is 192 feet. The bowsprit reaches 24 feet outboard. The main-gaff is 48 feet long, and the fore-gaff 36 feet long. The club topsail spars are 52 feet and 41 feet long. When the club topsail is set the head of the sail may be 150 feet above the water. The career of "Meteor III." will be watched with great interest, and there is no doubt that in the hands of such an ardent yachtsman as the Emperor she will be a constant competitor throughout the yachting season in European waters.

In point of size "Meteor III." should be compared with "Gleniffer," which previous to the launching of the Kaiser's yacht was the largest fore-and-aft schooner in the world. As it is "Meteor III." is slightly the larger vessel. "Gleniffer" is 157 feet over all, 26 feet 7 inches beam, and 18 feet 3 inches in depth. "Meteor III." is, therefore, 4 feet longer, 5 inches broader and 1 foot 3 inches deeper.

In placing the order for his last and finest yacht with an American firm the Kaiser paid a distinct tribute to the skill of our designers and builders in the construction of large cruising and racing schooners. The American schooner is as historically famous as the English cutter, and in proof of this one has only to call to mind such names as "America," "Sappho," "Henrietta," "Dauntless," and the more modern "Yampa," "Amorita" and "Colonia."

The Kaiser has tactfully requested the President's daughter to christen his new craft, and the occasion is to be rendered doubly famous by the presence of Prince Henry. The double-page supplement showing the great schooner as she will appear under full sail will have a timely interest for our readers.

GASOLINE AUTOMOBILES—1902 MODELS.

The Haynes-Apperson Two-Passenger Runabout.

The two-passenger runabout, 1902 model, shown by the Haynes-Apperson Company at the Chicago Exposition will embody the latest improvements incorporated in their machines. These include direct gearing, water circulation by means of a radiator and pump, a new design of steel wheel rims of greater strength than used in earlier machines, and improvements in the carbureter, clutch and a new pump feed lubricator. The motor is a double-cylinder engine with cylinders arranged horizontally on opposite sides of the shaft—an arrangement that gets rid of troublesome vibration. The sparking device is of the make and break positive contact type, which the company claim is not affected by wet weather and muddy roads. The particular model shown weighs 1,250 pounds; the motor is of 6 horse power, wheels are 32 inches in diameter, and the carriage is handsomely finished with leather upholstery. The machine has three speeds forward and one reversed, all controlled by a single lever. The Haynes-Apperson people entered two machines in the New York and Buffalo endurance contest, and they finished second and third out of a field of 89 that started. All of the Haynes-Apperson carriages are fitted with wood wheels, which the company claim to have found equal to the most exacting requirements of the road. A feature on which much emphasis is laid is the fact that they are larger in diameter than those customarily in use, and that consequently there is considerably less jar in traveling over rough roads than there would be with smaller wheels.

The Gasmobile Stanhope.

The Gasmobile embodies all the features of the best French machines, and the motor and machinery are so situated that they can easily be inspected.

The 25 h. p. four-cylinder engine of the Gasmobile stanhope, vertically disposed within the framework of the car, produces, when in motion, but a slightly perceptible vibration. The system of lubrication is most thoroughly carried out. Besides a small quantity of oil in the crank-case, automatic oiling devices are also provided. The water circulation is established by a rotary force pump. Both the inlet and exhaust valves are thoroughly water-jacketed. The Gasmobile vaporizer is highly efficient, simple in construction and never-failing. Its throttling feature, together with the quickly adjustable timing of the sparking device, make it possible to vary the speed of the motor over a range more than ample to secure the greatest variation in speeds desirable. Gasmobile engines are readily started notwithstanding their high compression. They are not, strictly speaking, high-speed motors. They are of slightly greater weight and larger proportions than other so-called high-speed motors, and therefore while quite as powerful as the latter, are more durable, since they do not run so fast.

The expanding friction clutch, which transmits the power from the motor to the driving-gear, ranks high among devices employed for this purpose. It is positive and substantial and will take hold of the clutch casing attached to the flywheel gradually, thus causing the car to start smoothly and without jerks.

At the right of the chauffeur three levers, forged from tough steel and operating on a double notched sector, serve for starting, stopping and reversing, and changing from the first to the fourth speed, as well as for operating the main brake.

The Gasmobile stanhope has a 71-inch wheel base and the regular standard tread of 56½ inches. All four wheels are 32 inches in diameter, and fitted with clincher tires. Three forward speeds and one reverse are furnished, and the 12 horse power motor will drive the machine as high as 30 miles an hour.

The Fischer Gasoline-Electric Omnibus.

The Fischer Motor Vehicle Company have for the past five years been perfecting a combination system, which possesses all the good qualities of the electric and gasoline combined, while the disadvantages inherent in each alone are practically eliminated by the combination.

The system consists of a combined gasoline engine and dynamo, one motor for each (rear) drive wheel, and small storage battery and controller. It will be noticed that there is no mechanical connection between the engine shaft and vehicle drive wheels, therefore the dynamo is free to run at a practically even speed, producing a constant supply of electricity. The electric circuit is so arranged that when running the vehicle under normal conditions (loaded on the level) the current goes directly from the dynamo (through the controller) to the motors; but when coasting down grade, slowing up or in general when less power is needed than that furnished by the engine, the current is automatically taken up by the battery, which is connected to the wiring at a point between the dynamo and controller. Again, when extra power is needed, as in ascending steep grades or starting heavy loads, the battery promptly furnishes the deficiency. This action—the carrying the peak of the load—does not have to be watched by the operator, being entirely automatic. As the output of the engine does not vary, no governor is required, and the gas and air mixtures can be set permanently for perfect combustion. This insures great saving in fuel and prevents the usual bad odor. As the speed of the engine is almost constant, the balance is nearly perfect, thus preventing vibrations. Another very important and convenient feature is the starting of the engine, which is accomplished by simply throwing in a switch controlled by the driver.

Fig. 1 shows an 18-passenger omnibus recently completed. Fig. 2 is a photograph of one of the standard running gears, which consists of an angle steel underframe to which various parts of the machine are attached. The front portion carries the gasoline engine, dynamo, controller, and steering gear. The front axle, instead of being made of the usual heavy forging, is trussed somewhat on the principle of a bridge, and carries extra long and flexible platform springs, bolted to the brackets on the frame. The rear axle with the wheels, springs, two motors and reduction gears forms a complete driving unit. All parts subject to wear are entirely incased so as to be properly lubricated and at the same time protected against dust and moisture. No reach is used, the half-elliptic springs conveying the power from the rear axle to the frame. The water cooler is suspended under the frame between the front and rear axle. The illustration, Fig. 2, shows the running gear complete in every respect, and Fig. 3 the body in place, making a finished bus.

The power equipment consists of a 10 horse power,

3-cylinder, 4-cycle gasoline engine running 600 revolutions per minute. Directly on the engine shaft is placed the armature of a 5-kilowatt 110-volt dynamo. The motors are of special "twin" type (built together), 5 horse power each, and will stand an overload of 100 per cent for a half hour, or 200 per cent for 5 minutes without sparking at brushing. The controller is of the series parallel type of five forward speeds of from 2½ to 10 miles per hour, and two reverse speeds of 2½ and 5 miles per hour, all controlled from one lever. The batteries consist of 50 cells of 90 ampere hours' capacity. The front wheels are 38 inches in diameter and the rear 46, all equipped with 4-inch Calumet solid rubber tires.

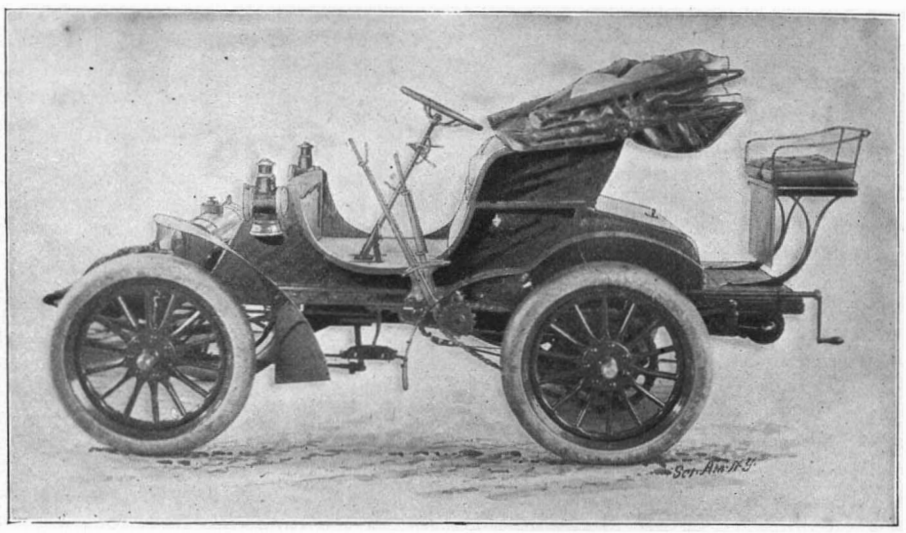
In a test recently made of this bus by one of New York's largest automobile corporations, it developed that the bus not only made its scheduled time during a snowstorm, but that the heating apparatus kept the inside comfortable while the weather was below freezing point. The total mileage made by the bus on this day was 54, the engine using 12½ gallons of gasoline, same costing 9 cents per gallon, making the cost of fuel a fraction over 2 cents per mile, and this under the very worst conditions that an automobile could be asked to work under—snow.

The company has orders for a number of heavy trucks, some of them being of the beer truck type, built to haul seven tons.

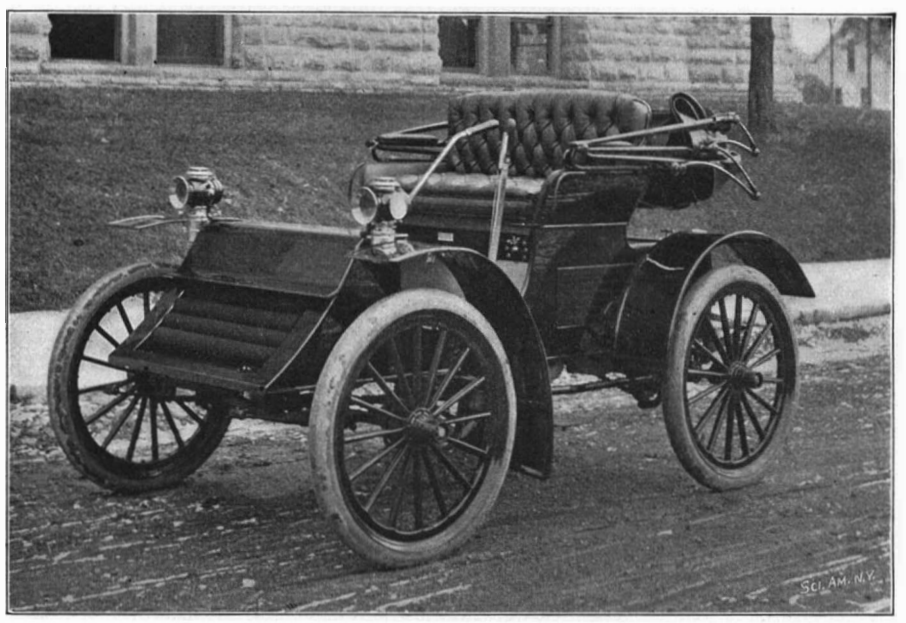
Peerless Touring Car.

The Peerless motor car has a long wheel base and low center of gravity, with motor situated in front. The frame is built of channel iron after the style of a locomotive, thus carrying out the idea that the motor car is a road locomotive rather than a horseless carriage. Both front and rear wheels are pitched inward, after the manner so long in use with all vehicles not run on prepared tracks. The pitch of the rear wheels is made possible by the flexible driving axle, which also obviates all loss of power by excessive friction when strains of the road tend to throw the rear wheels out of alignment.

The motor consists of two vertical 4 x 4⅜ inch cylinders, with cranks inclosed in tight aluminium cases and running in oil, an arrangement which automatically lubricates the cylinders and all bearings. Owing

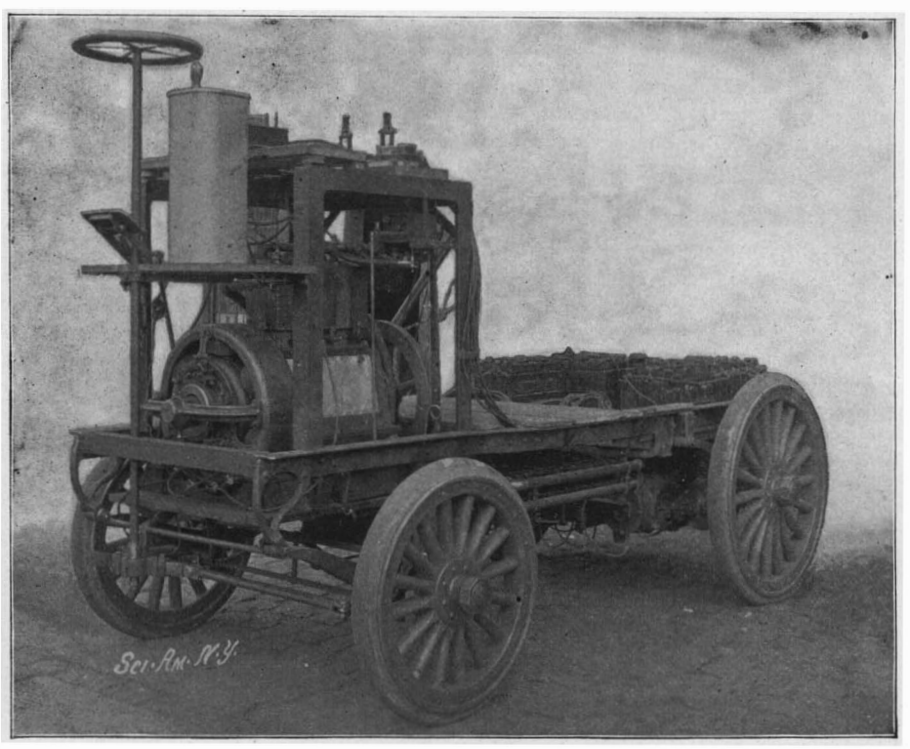


The Gasmobile Stanhope.

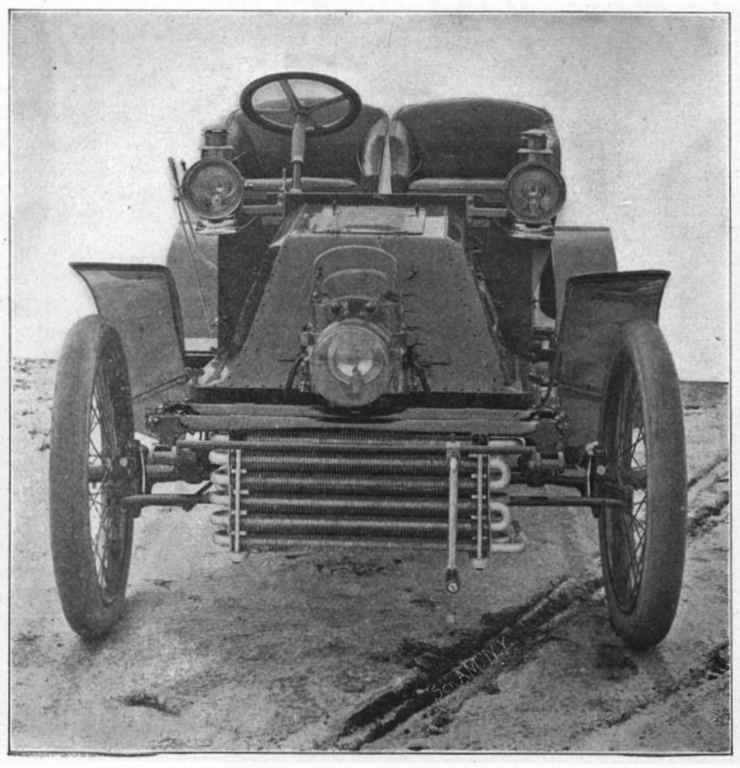


The Haynes-Apperson Gasoline Runabout.

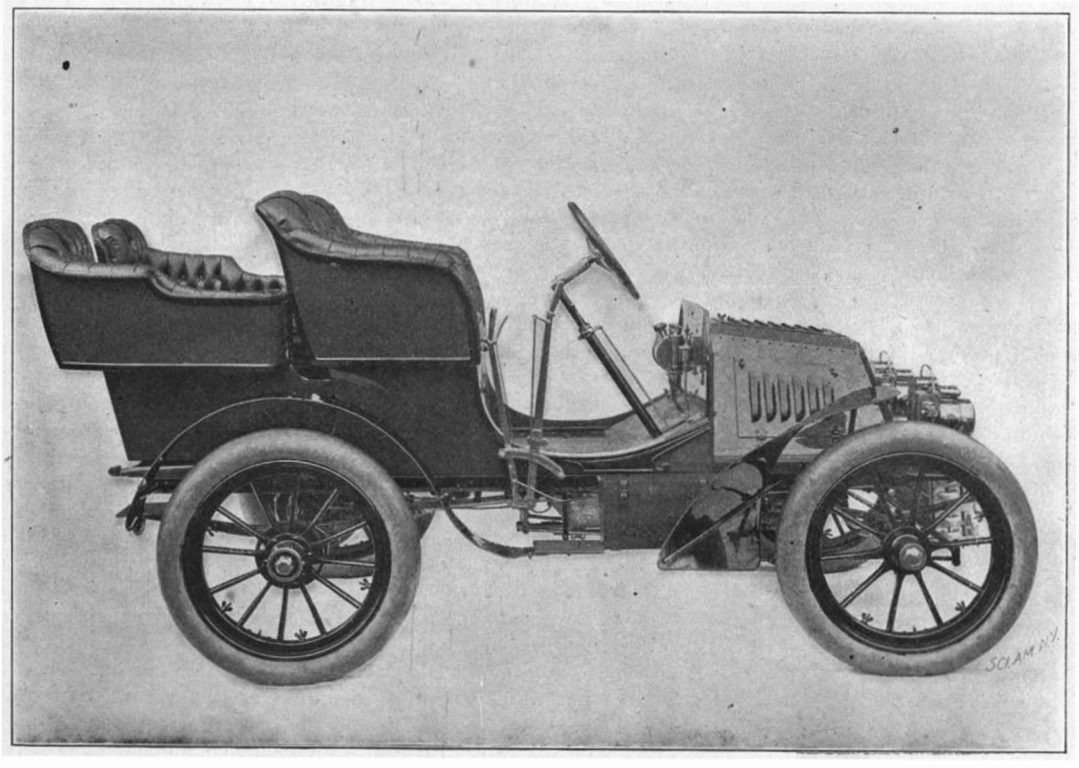
The Fischer Gasoline-Electric Bus.



The Fischer Bus With Body Removed.



Front View of Peerless Touring Car.



The Peerless Gasoline Tonneau.

GASOLINE AUTOMOBILES—1902 MODELS.

to the vertical position of the cylinder it is thoroughly lubricated, since the piston rings wipe uniformly the entire circumference, and thus prevent any oil getting into the firing chamber, which does away with obnoxious odors and keeps the spark plugs clean. Both grease cups and force feed lubricators are used throughout the machine, and all are situated on the dashboard before the driver. The mufflers used produce very little back pressure and yet almost eliminate the noise of the exhaust.

Ignition is by the jump spark system, the make and break of the circuit being accomplished by means of a mechanically operated vibrator of unique and entirely original design, which requires no adjustment for months. Heavy insulated cable is used in all the wiring.

A circulation of water through all the engine jackets is obtained by means of a centrifugal pump operated by a friction disk against the flywheel. The water is pumped through a very effective system of radiating coils at the front of the car, and only two or three gallons are used.

An atomizing float feed carbureter of improved design, requiring absolutely no adjustment to the varying speeds of the motor, is used to furnish gas for the latter. The motor is started by a half turn of the crank, which is placed at the front of the car. The speed gear is connected with the driving gear by a flexible shaft and with the motor by a universal coupling, which protects the bearings, gears, and clutch from any strain due to an inequality of the road. The gears are inclosed in an aluminium case and run in an oil bath which automatically lubricates all bearings. The speed changes are obtained by means of a single lever at the right, which gives three speeds forward and one reverse, while the speed of the motor is regulated by varying the time of the spark.

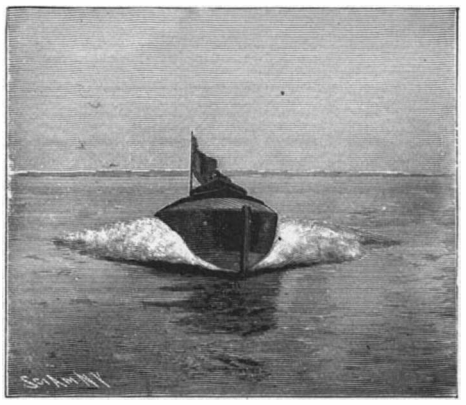
The changes of speed are made by friction clutches that go in without clatter or vibration, and the gears operate without noise. A powerful band brake on each rear wheel is operated by a lever at the right and held by a ratchet until released. A foot brake operates on a drum on the change gear shaft between the motor and the compensating gear.

All two-passenger cars have a rear platform which may be used for luggage, rumble seat, or two-passenger tonneau. The driver's seat is either double or divided into individual seats. The cars are geared to make 30 miles an hour at a speed of 1,200 R. P. M. of the engine, but are capable of being speeded up to 40 miles an hour. They are equipped with two kerosene side-lights and a very powerful acetylene headlight, or with two side-lights and two acetylene headlights having a combined power about equal to the single headlight which is offered as an option. The mudguards are of aluminium with front guards flared out, protecting both occupants and the car from mud when the wheels are at an angle.

HIGH-SPEED TWIN-SCREW YACHT "VIXEN."

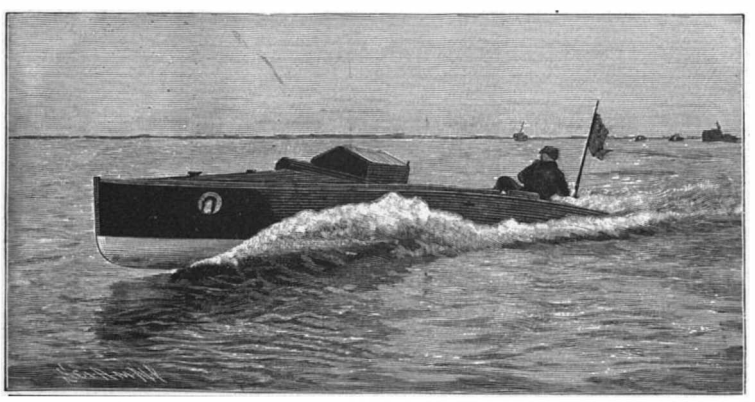
There are few cities in the world that are so advantageously situated as New York city for the running of a system of suburban transportation by water, and we venture to think there is no city where these natural advantages are so little taken advantage of. It is true there has been some talk recently of running a line of high-speed passenger steamers between New York city and suburban towns on the Hudson River, which was to be capable of making a speed of 30 knots an hour, and competing with the railroad service; but the scheme seems to be in abeyance, if it has not altogether fallen through. Practically the only travel of this kind that is done is due to the owners of private yachts, many of whom make the journey every day by water between their residences on the Hudson and along the Sound and New York city. The convenience and pleasure of this method of travel are obvious.

We present illustrations of a high-speed yacht which has been built by the Gas Engine and Power Company, Morris Heights, New York, for Mr. Archbold, who will make use of it principally for the run between his home in Tarrytown and his business in New York city. The dimensions of the vessel are: Length over all 100 feet, load waterline length 96 feet, beam 12 feet, and draft 4 feet. The "Vixen" has been modeled for high speed, and she has the fineness and sweetness of lines which are seen on the fast torpedo craft. The framing and planking are of wood, the boat being double-planked and copper fastened; the sheer strake, deck stringers, floors and keelsons are of steel, as are also the bulkheads. The vessel is driven by twin-screw engines which, when running at a speed of 450 revolutions per minute, will, together, indicate 500 horse power. The guaranteed speed is 20 miles per hour, and the builders expect to get between 21 and 22 knots an hour on the trial trip.



BOW VIEW.

A steel trunk-house extends for about two-thirds of the length of the vessel amidships, and forward of this is a deck-house or pilot-house of red mahogany, paneled, which will be utilized as a dining room, for which purpose it can accommodate six persons. Immediately abaft of this structure comes the trunk-house, which extends from the deck-house to the after end of the owner's quarters. The accommodations below deck are as follows: In the forecastle are the quarters for the crew. Aft of these is a large galley in which a dinner can be prepared and served by connection to the dining saloon above. Abaft of the galley are the boiler room and coal bunkers. Then follows the engine room, and aft of this is a large stateroom for the owner, which extends to the full beam of the vessel and is fitted with two berths, a dresser, lockers, etc., and has a toilet adjoining. Aft of this, again, is a large saloon. The stateroom and saloon are finished in white enamel and gold.

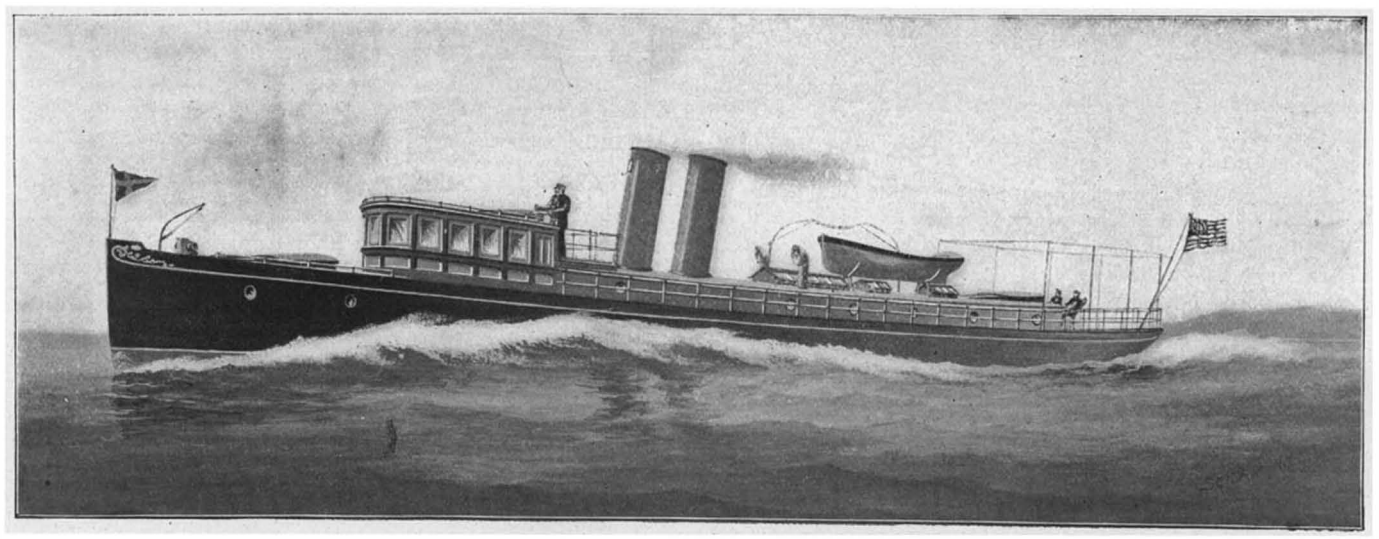


Length, 39 feet 3 inches. Beam, 4 feet 3 inches. Horse power, 25.

"ROLLO" AT EIGHTEEN KNOTS AN HOUR.

The motive power is of what might be called the torpedo-boat type; that is to say, it consists of water-tube boilers and triple-expansion, fast-running engines. The object aimed at in the motive power is the reduction of dead weight by securing a high average indicated horse power per pound of weight. The boilers are of the well-known Seabury safety water-tube type. Particular attention is given in the design to the circulation of water. By using the outer water-tubes for returning the water to the bottom of the boiler a much larger area is secured for the return water than could be obtained by using large return pipes. The furnace is surrounded by water-tubes that have the same opening between them as the diameter of the tubes, and ample room is thus left for the gases to pass freely among all the tubes for their entire length. The firebrick baffle-plate between the tubes above the furnace absorbs a part of the heat when the fire is very hot, which is given off again when fresh fuel is put in the furnace, a certain amount of reverberatory effect being thus secured. There are a series of horizontal tubes on each side of the steam drum for the purpose of superheating the steam. The triple-expansion engines have cylinders 7 inches, 11¼ inches and 17½ inches diameter by 10 inches stroke. Care has been taken to remove all superfluous metal from the revolving parts, and it is thus possible to secure a high rotative speed with a minimum of vibration.

The yacht is finished with a stern of the torpedo-boat type; and with her twin funnels, low trunk, and single deck-house forward, she has a decidedly smart and rakish appearance.



Length, 100 feet. Beam, 12 feet. Speed, 20 knots.

NEW HIGH-SPEED TWIN-SCREW YACHT "VIXEN," NOW BEING BUILT FOR MR. ARCHBOLD.

THE MARINE AUTOMOBILE.

THE RECENT FRENCH INVENTION OF THE AUTOMOBILE LAUNCH.

Automobiling on water has now become an accomplished fact. French engineering skill has turned the features common to the racing automobile into use for propelling the long, slim body of the automobile launch through the water at a furious rate of speed. The machinery is the same as in a high-power automobile, the manner of transmitting power is the same, the fuel, the motive power and the manipulating devices are practically identical. The only actual differences are that the motive power instead of being carried on wheels is incased in a smooth wooden canoe skin, offering a minimum of resistance to the water, and that the device steers by rudder instead of by mechanism acting on the front axle. In all other essential respects the automobile launch and the automobile carriage are virtually alike. A competent chauffeur can handle either type, and it would not be impossible to build a motor vehicle out of the machine parts belonging to a motor launch—so closely identified are these otherwise apparently dissimilar means of travel.

It is quite natural that the sport of automobile launch racing should receive its baptism in France, the native home of automobilism, for the French, though poor at yachting as a nation, enjoy a well-merited reputation in the line of light craft for pleasure boating.

The motor as well as the hull herewith shown were specially designed for racing, and it was found that the motor worked perfectly under all conditions, starting with a half turn of the handle and maintaining its speed smoothly and regularly. The type of motor adopted was that made famous by the Panhard & Levassor establishment, makers of the Panhard automobiles. The superintendent of the factory, M. Krebs, selected a 24 horse power gasoline motor and made some minor changes in it to fit the marine equipment of the launch. After considerable experimenting it was found that the motor under favoring circumstances actually developed more horse power than its indicated rating, and then the idea of racing this new and strangely unfamiliar craft occurred to M. Giraud. He applied to the Helix Club of France for a series of trials over measured distances of salt water, entering his craft under the name of "Rollo"—an automobile canoe measuring 39 feet 3 inches in length, with a beam of 4 feet 3 inches and 24 indicated horse power. The first race took place at a course near Argenteuil, in which "Rollo" was entered among a number of high-power launches of her class. She finished a winner of the 24-kilometer (14.90 statute miles) course in 1 h. 17 m. 31 s., a speed of 11.53 statute miles. In a subsequent race at the Cercle de la Voile de Paris at Meulan the course was 52 kilometers (32.30 miles) and

her time 2 h. 41 m. 28 s., or a trifle over 12 miles. In the Helix Club de France races the course was 48 kilometers (29.80 miles), and "Rollo's" time was 2 h. 8 m. 3 s.; equal to a speed of 14 miles. In a 24-kilometer brush under H. C. de F. rules she made the distance in 55 m. 25 s., a speed of 15.67 miles, or a gain of 22 minutes 6 seconds over her initial showing. This progressive improvement reflects much credit on M. Telliér, who had charge of the motor in these races. In order to try her on the deep seas M. Giraud had her transported by rail from Paris to Lorient, on the Bay of Biscay, and under his management and the assistance of an engineer "Rollo" was safely sped down this dangerous coast to the fashionable watering place Arcachón, a distance of some 200 miles, making an average speed of 13 knots, mostly in the open sea. This is probably the finest achievement by any power-propelled launch or canoe of like measurement and capacity, and won for M. Giraud a leading place in the development of the new sport. On a certain occasion, the tide favoring, "Rollo" slid over a measured mile on the Seine River at a clip that would have placed 25 miles to her credit within the hour had she continued for that time. It was on this occasion that the photographs herewith shown were taken by M. Giraud. One picture represents the start, when the craft cleaving the water at stop speed comes tearing down on the mark. M. Telliér is seen at the rudder sitting sideways in the cock-pit so as to better manipulate the engine and the steering simultaneously. It will be seen that the force with which the craft is urged is sufficient to lift its nose well out of the water. The other view shows "Rollo's" looks as she comes tearing through the brine head on for the stake.

Automobile launching or "canoeing" as the French call it, is not only now recognized as a distinct development in light craft engineering, but as a sport with rules and tenets of its own. A great many wealthy French sportsmen have had auto canoes constructed on the lines of "Rollo," the pioneer, and on the other side of the Channel the fever has caught on to the extent of putting several such craft into commission for racing the French during the coming season. That most energetic of launch-owner organizations, the Helix Club of France, is about to organize a technical committee composed of engineers and other specialists, under the presidency of Count Récopé, in order to gather reports regarding new developments in pleasure and racing navigation with light draught power craft. The club, which is one of the most influential in France, seems to realize that the industry of automobile launch building is still in its infancy despite the wonderful performances of M. Giraud's "Rollo," and its members have settled down to the task of perfecting the sport with much enthusiasm.

When the British and French automobile launch fleets meet early in the spring to decide the proposed international launch championship, interest will not only center in the spectacular feature of the speed performances, but also in the comparative test of the English system of power propulsion against the French.

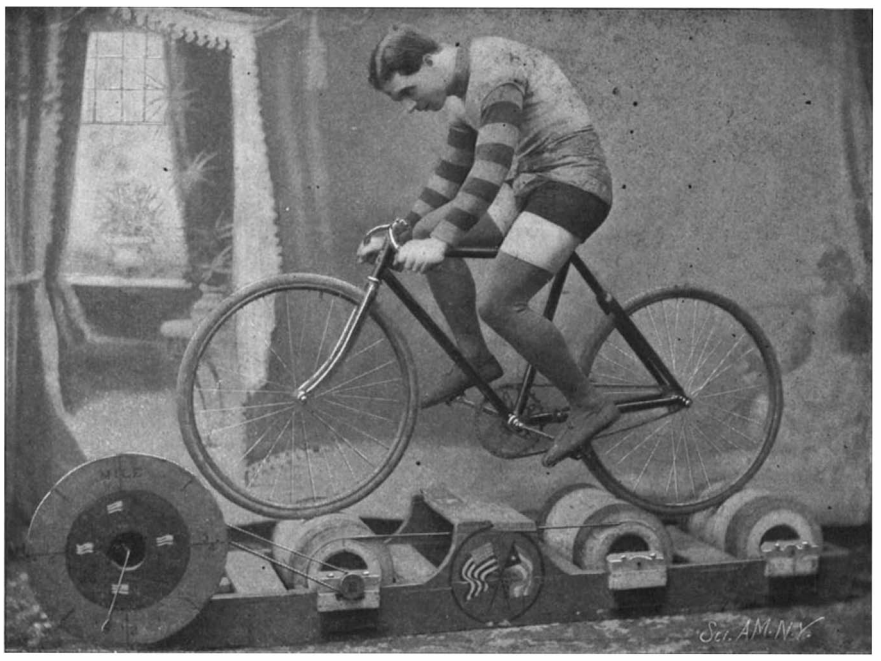
The races, which are scheduled to include a brush across the Channel from Dover to Calais, may, nevertheless, be close enough to excite an interest vying in popularity with that surrounding international yacht races. We are indebted for our particulars to Le Sport d'Automobile Canot.

THE CYCLE WHIRL.

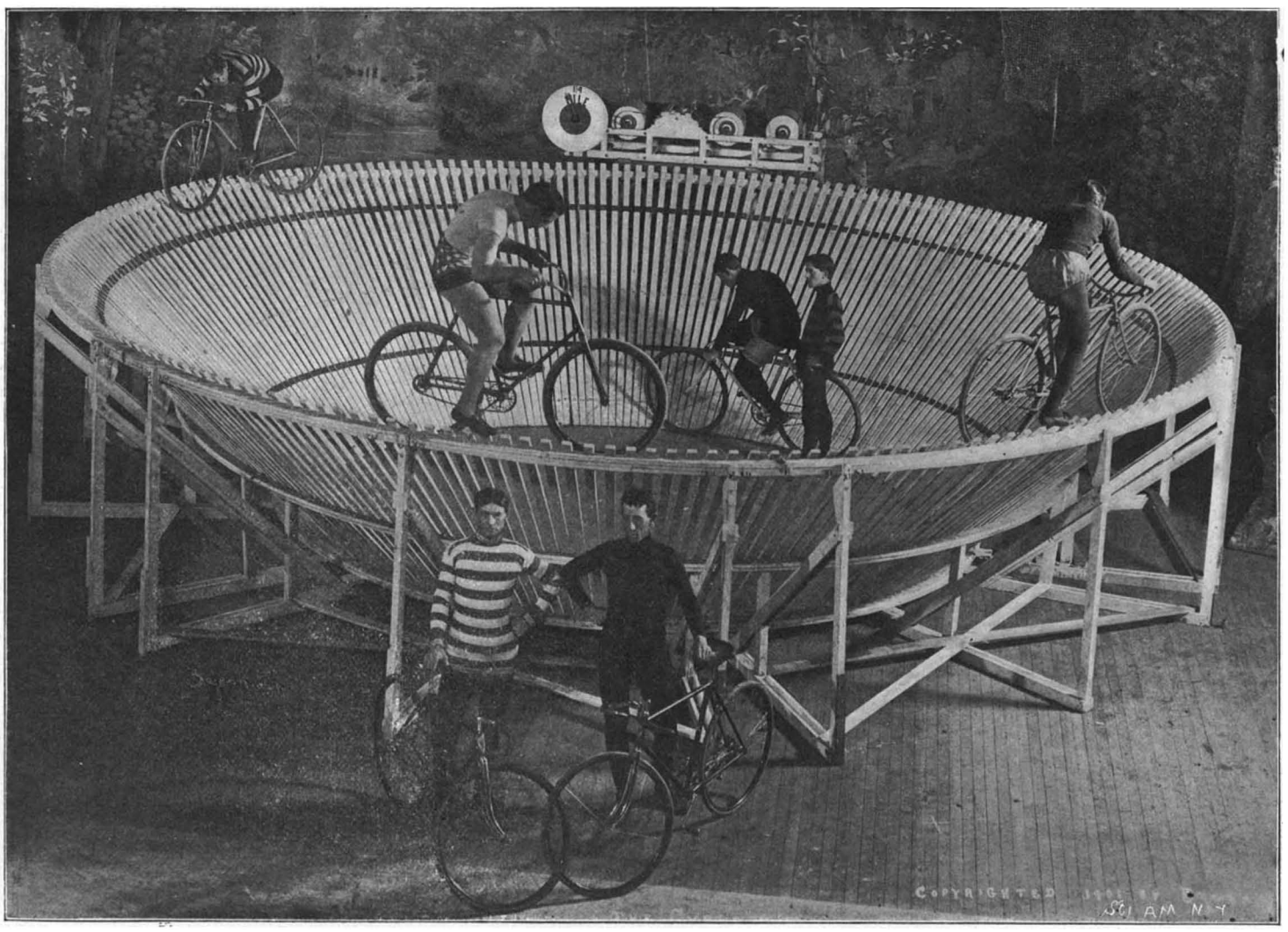
Some two months ago there was on exhibition at Proctor's 23d Street vaudeville theater, in this city, an indoor racing track, on which expert bicycle riders daily performed. This track, instead of being made oval in shape, with the ends banked, as is usual in outdoor practice, had necessarily to be circular in order to fit on the stage. It forms, as a glance at the illustration will show, an inverted, truncated cone of slats with diameters across the top and bottom of 25½ and 14½ feet respectively. The slats of the cone are set at an angle of 45 degrees with the stage and are 8 feet in length. Within this miniature race track, upon the rising of the curtain, are seen several bicyclists with their machines. Starting at the bottom of the cone slowly and carefully, they circle around it with increasing speed, climbing higher and higher toward its upper edge while their bodies lean more and more toward the inside and finally reach a position where rider and wheel seem nearly horizontal as they go spinning over the clattering slats. The pacer, Schreyer, on his stationary trainer, increases the pace, and the pointer of the indicating dial plainly shows to the audience this increase as the quarters and halves are run off. Faster and faster go the racers till they are circling around the track in one mad whirl. A pistol report sounds. The riders plunge to the stage, drop their wheels, and make a dash for the top of the slats. The one who reaches the top first is considered the winner.

The trick rider, Schreyer, next performs on the inclined track, riding around it and plunging from top to bottom and vice versa till it seems as if he must surely run off the upper edge or be dashed onto the stage at the bottom. He also uses an electrical bicycle, which is arranged with insulated copper wire brushes that rub on the spokes of the front and rear wheels. Flexible wires from above are connected, one to the brushes and one to the frame of the wheel. As he circles around the track in semi-darkness myriads of brilliant sparks are showered from the two wheels, producing a very pretty and dazzling effect. Next he rides around the circle with hands off, and then repeats this feat with a boy on his shoulders.

The Cycle Whirl was so named by Manager Proctor, who imported the act from London, where it was originally produced last summer by an Australian trick cycler, Charles Jones. It proved to be a startling and interesting feature of the usual vaudeville performance, and was soon copied by other of the vaudeville theaters. After the six-day bicycle race in Madison Square Garden the champions were seen daily in races on this miniature track.



SCHREYER ON HIS STATIONARY PACING MACHINE.



THE CYCLE WHIRL.

The advantages of the gasoline engine are forcing themselves on the officials of several of the larger Western railroads. Experiments with gasoline "hand" cars have demonstrated the entire practicability of such vehicles for inspection and repair purposes. Not only is it possible to travel much more rapidly and with the expenditure of a minimum of muscular energy — sufficient only to start the motor — but the vehicle equipped for service is so light as to be easily handled by the crew. Besides, if necessary, a small flat car containing additional tools and men can be attached to the motor car and hurried to the spot where quick repairs may be necessary. So entirely successful have these experiments been, indeed, that it is quite possible that another year may see the majority of the larger railroads throughout the country supplied with self-propelled "hand" cars.

An automobile exposition will be held by the Automobile Club of Great Britain and Ireland from April 19 to 26 next in the Royal Agricultural Hall in London. The exhibits will be divided into sections as follows: Automobiles; detachable parts and pneumatics; motors and generators; accessories and carriages; material and machine tools; covering clothing, etc. The exhibition will be a very important one, and inquiries for space and further information should be addressed to Mr. Cordingly, 39 and 40 Shoe Lane, London, E. C.

AN AUTOMOBILE SLED.

The Nuernberger Motorfahrzeuge-Fabrik "Union" is about to manufacture an automobile sled, of which we reproduce herewith a photographic illustration. By reason of the fact that the mechanism has not been as yet fully perfected by patents we have not been able to secure full details of the construction and operation of the sled.

AN AUTOMOBILE SLED.

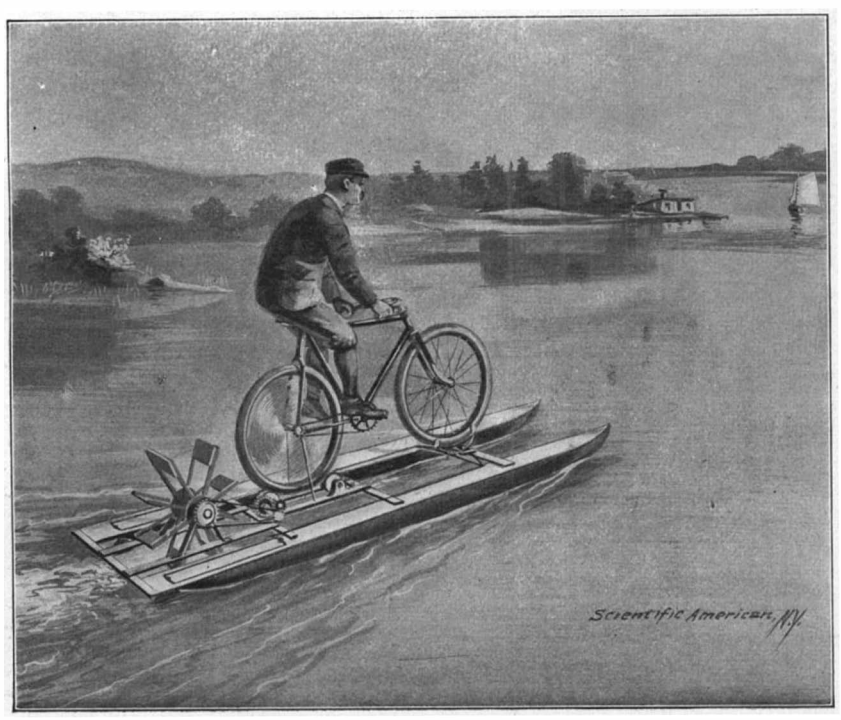
So far as we have been able to learn the sled is driven by a benzine motor, water-cooled and equipped with electro-magnetic sparking devices. The cooling water circulates in the body of the sled, through pipes which are so disposed as to constitute a foot-warmer.

The steering gear includes a tiller, which is connected with the front runners. A single lever controls the direction of the motor shaft's revolution. Various speeds are obtained by operating a hand-wheel mounted on one side of the sled. So far as we have been able to learn the sled is driven by a spiked wheel, which bites the ground and which is geared up to the motor shaft.

A BICYCLE-DRIVEN CATAMARAN.

An American inventor has hit upon the idea of using his bicycle to drive an ordinary catamaran. The bicycle is suitably supported above the two connected boats, the rear wheel engaging two friction rollers. The shaft of one of these friction rollers carries a pinion meshing with a gear carried on a second shaft. A sprocket-wheel on the gear-shaft is connected by means of a chain with a sprocket on a paddle-wheel shaft. It is evident from the illustration that by propelling the bicycle in the usual way, the rear wheel, acting through the medium of the friction-rollers and the transmission gearing described, will turn the paddle-wheel and drive the catamaran forward.

The traveling radius of electric vehicles, even in large cities, being necessarily limited by the scarcity of charging stations, a Brooklyn (N. Y.) physician has perfected a scheme whereby he can replenish his batteries from the omnipresent trolley wires. As such action, without permission, would constitute larceny, he has attached an electrometer to his carriage, and is prepared, in the event of the officials' acquiescence, to pay for all electricity so "borrowed."



BICYCLE-DRIVEN CATAMARAN.

The Scope and Purpose of the Scientific American.

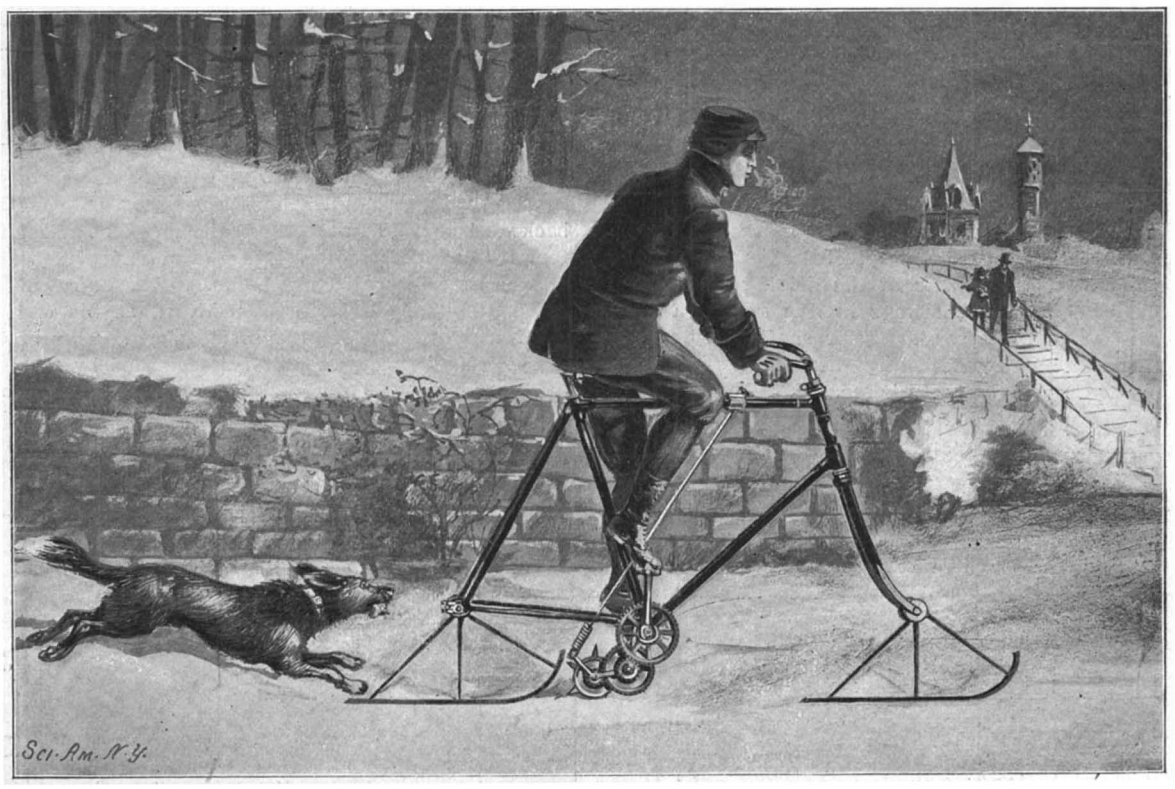
For the reason that the present number is a Special Issue, it will fall into the hands of many readers who may not be perfectly familiar with the SCIENTIFIC AMERICAN, that is to say, who do not have the opportunity to read it week by week, and who, therefore, have no clear idea of its contents, or the general aim and purposes of the paper. For their information we may say that the SCIENTIFIC AMERICAN claims, broadly speaking, to give a weekly record of every event of importance that occurs in the scientific world, while, as soon as the necessary data is obtainable, events of the first importance are to be found described in full detail, and, as far as possible, made clear by illustrations. Of course, there are some subjects which do not lend themselves to detailed description within the limits of the space at our disposal in the SCIENTIFIC AMERICAN, and in such cases, they will be found in the columns of the weekly SUPPLEMENT. It is unnecessary to attempt to enumerate the branches of science which are embraced in a programme as broad as that above described, nor do we claim that equal attention is paid to all branches of science and art. By way of reference to the work we have done in the past, we may mention the illustrated articles which have appeared under the head of "Transportation," whether by steamship, steam railroad, or on the enormous network of street railways with which our cities and much of our interurban districts are covered; and the series of industrial articles which has been running periodically for many years. The development of our navy and our sea-coast defenses has received most ample treatment, and every new battleship and cruiser and all new types of ordnance are illustrated as early as the official drawings and plans of the same are obtainable. Many of the special issues on naval matters are receiving semi-official recognition by the Navy Department. Each number of the SCIENTIFIC AMERICAN contains a front page made up entirely of illustrations, and upon this page may frequently be found those full-page diagrammatic comparisons of massive machinery, great industrial enterprises, etc., for which this journal has become famous. Then follow two pages of editorials which are mainly devoted to the discussion of scientific topics of the day. Of the following eight pages, five or six are richly illustrated, chiefly with photographic and wash-drawing reproductions, which are supplemented with line cuts, as far as the latter are necessary to describe the details and operation of the subject in hand. Each issue contains several columns of science, engineering and electrical notes. A new feature which has recently been added and has become extremely popular, is a special patent department, in which a selection of the most promising current inventions is described and their salient features shown by illustrations. Under this head is a department of legal notes and a list of recently patented inventions. We think we may claim that the SCIENTIFIC AMERICAN is entirely unique among the scientific journals of the world in respect to the extent of the field covered and the success which it has achieved in interesting both the highly trained specialist and the layman who has not the time available for taking more than a cursory interest in current scientific events.

A SNOW BICYCLE.

On many of our country roads the safety bicycle has to some extent taken the place of a horse and carriage. But during the winter, when the ground is covered with snow, recourse must still be had to the horse. Benjamin C. Trudelle, of Bay City, Mich., evidently would like to use the bicycle in all kinds of weather; for he has invented what he calls a winter velocipede, with which he hopes to do what cannot be accomplished with an ordinary bicycle. As a matter of course, runners take the place of wheels.

The driving-gear of this curious machine consists of a spur-gear fixed to the crank-shaft of the bicycle, and a pinion meshing with the spur-gear, the shaft of which is rotatably mounted in a bearing carried by the lower end of a bracket secured to the bicycle frame. The opposite end of this shaft carries a gear meshing with a pinion rigidly attached to a spiked driving-wheel. Evidently, by rotating the main spur-gear through the medium of the pedals, the spiked wheel is turned forwardly.

In order to adjust the height of this driving-wheel and to enable it to yield when overriding obstructions, the inventor resorts to a peculiar device. A vertically-movable arm is pivoted to the lower end of the bracket carrying the bearing previously referred to. An upwardly-extending adjusting-rod is fixed at its lower end to this vertically-movable arm and is secured at its upper end to the bicycle-frame. A collar secured to the lower part of the rod opposes the thrust of a spring, which resists the upward thrust, thus permitting the driving-wheel to override obstructions.



A BICYCLE ON RUNNERS.

A portable automobile house has been recently put on the market, the design and manufacture of F. F. Hodgson, of Dover, Mass. This is designed to meet the wants of owners who may desire a temporary house at a country place or resort where they may be stopping for a short season, and also for others who do not care to go to the expense of erecting an expensive shelter for the carriage. This house is built of cypress, and is shipped painted and in sections which can be put together by anyone having the slightest knowledge of the use of tools. There are three sizes, but the most popular is 10 feet square and 9 feet high at the peak. The door is 6 feet wide and 6½ feet high. There are two large windows on each side of the stable and an outside incline.

Mrs. A. B. Cleveland, of Unionville, Ohio, is the owner of an automobile which she drives herself. It is her custom to do her shopping in Cleveland, which is forty-five miles away, and this trip she makes quite often. She leaves her home early in the morning, and is always back before nightfall. She says that the use of the automobile gives her a longer time in Cleveland than when she makes the trip by train.

THE PACKARD GASOLINE TOURING CAR.

The Packard gasoline automobile is a very good example of the latest and most successful American practice, and shows what can be accomplished by following persistently a given line of design. The manufacturers have succeeded in producing a smooth-running, powerful machine of the greatest possible simplicity and reliability, using but a single cylinder, four-cycle gasoline engine of what may be termed the Benz type. By means of the special construction of transmitting gear and engine control described below the shock of the explosions in the engine are greatly reduced and communicate no perceptible annoying vibration to the body of the carriage.

One illustration shows the general appearance of the Model F Packard machine with detachable tonneau body, and the other the complete mechanism without the body. The frame of the machine is made of one piece of channel steel bent to shape and reinforced with longitudinal and cross braces. To this is securely bolted the engine, which rests in a horizontal position with the cylinder end to the rear, and the inclosed gear case containing the change speed and driving gears. No underframe, so common in American practice, is used, but instead the rear axle is connected to the main frame by means of radius rods whose forward ends are pivoted at practically the same point as the center of the driving shaft, thus keeping the rear axle always in line and at a fixed distance from the secondary gear shaft carrying the driving pinion. By adjusting these radius rods the proper tension of the chain is secured. Bending of the springs is not depended upon to allow for forward and back motion of the rear axle, but the springs are of double elliptical section, the upper section being connected to the lower by links, allowing the necessary fore-and-aft motion. The front axle is connected to the frame by a parallel-motion device, consisting of a simple pair of ball joint rods reaching forward on a bracket bolted to the channel frame and a corresponding bracket on the front axle. The usual construction of semi-elliptical springs in front is abandoned in favor of the double cross spring, which allows the maximum of flexibility, giving in effect a three-point support to the main frame. This is clearly shown in the illustrations. Steering is by means of hand wheel fitted with worm and sector, and is nearly irreversible so that shocks communicated to the front wheels are not transmitted to the steering wheel. The action, however, is not entirely rigid, and undue strains on steering gear and parts are thus avoided. The wheels are of the artillery type with fourteen 1½-inch wood spokes. They are 34 inches in diameter, and fitted with 4-inch single-tube or clincher tires. The rear axle is provided with the usual spur gear differential driven by 1½-inch pitch roller chain. Ball bearings of ample size are used.

The speed-changing gears are carried on a short shaft directly in line with the engine shaft and connected with it through the clutch and spring transmission seen in the flywheel in the view of the mechanism. This spring transmission prevents much of the hard blow of the explosion from being imparted to the rear wheels and the body, and undoubtedly contributes greatly to the smooth running and long life of the transmission gear. It is an added advantage that the engine shaft and the gear shaft may be thrown out of line without producing strain or undue friction, as the driving plate of the clutch is loosely keyed to the spring-driven spider in the flywheel, making practically a universal joint. Directly below the main gear shaft is supported an intermediate gear shaft carrying the driving sprocket. On this latter shaft is a fixed train of gears. The main gear shaft carries two sets of shifting gears. By means of the single gear shift lever, *C*, these gears are engaged as desired, giving three speeds ahead and one reverse, but only one pair of gears can be engaged at a time, and the operation consists simply in placing the lever in the desired one of four slots in the H-shaped speed-changing gear standard. An interlocking safety device is provided by which gears cannot be shifted when the driving clutch is in engagement. Thus any possibility of stripping gears by making a mistake in shifting is avoided. The arrangement shown has a distinct advantage over the well-known Panhard system in that whatever speed is desired can be picked up directly without passing through the intermediate speeds. Thus if the carriage has been running on the high speed and it is desired to put in the reverse it is not necessary to shift through the intermediate and slow speeds, but the high-speed gears are thrown out and the reverse gears are engaged by one operation of the lever. When the proper gears have been put in mesh the clutch is engaged by pulling backward on the clutch and brake lever, *D*. Pushing forward on this same lever throws out the clutch and applies the powerful band brakes to the rear wheels. An auxiliary band brake is provided at the end of the intermediate gear or sprocket shaft. This brake is applied by means of pedal, *A*, operated by the left foot. The speed of the engine can be regulated from 100 to the usual maximum of 850 revolutions per minute by pressing on the foot pedal, *B*. This, by plain rod connections, actuates a wedge sliding across the admission valve and limiting its opening.

Considerable weight is saved in the engine construction by the use of a cylindrical copper water jacket. This has been found in practice to be entirely trustworthy, giving no trouble from leakage. By doing away with the casting of the jacket assurance of a better cylinder casting is given, while the jacket can readily be soldered should it spring a leak from water freezing in it. Forced circulation is used for cooling the water jacket, and is assured by a centrifugal pump on the longitudinal cam shaft of the motor, which operates the exhaust valve and carries the contact-making apparatus as well. Ribbed and flanged cooling coils are carried below the frame in front of the wagon body. All the bearings of the motor and transmission gearing are lubricated from a direct-connected multiple oil pump, *G*, placed just back of the engine cylinder. The receiver of this pump will carry sufficient oil for a run of fully 200 miles. The main and secondary gear shaft bearings and the gears themselves are automatically lubricated by oil contained in the tight gear box.

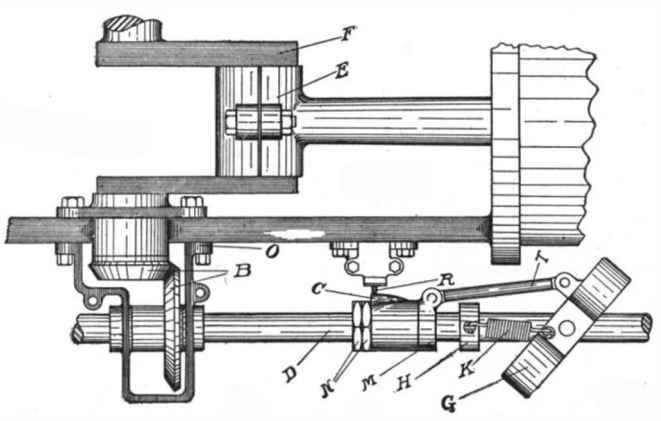


Fig. 1.—PACKARD IGNITION GOVERNOR.

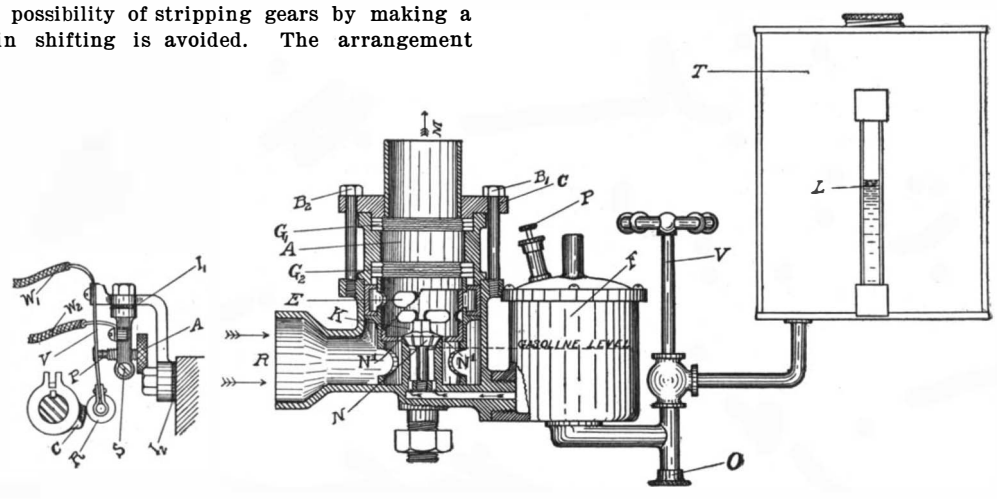
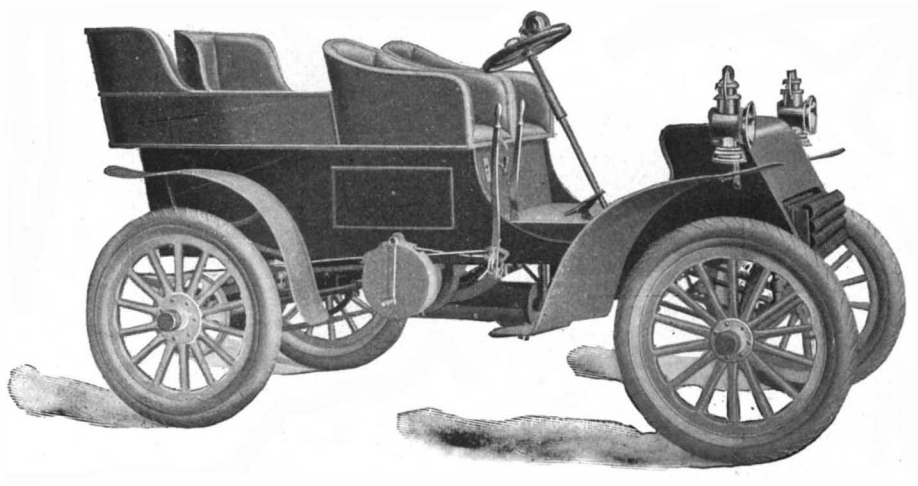


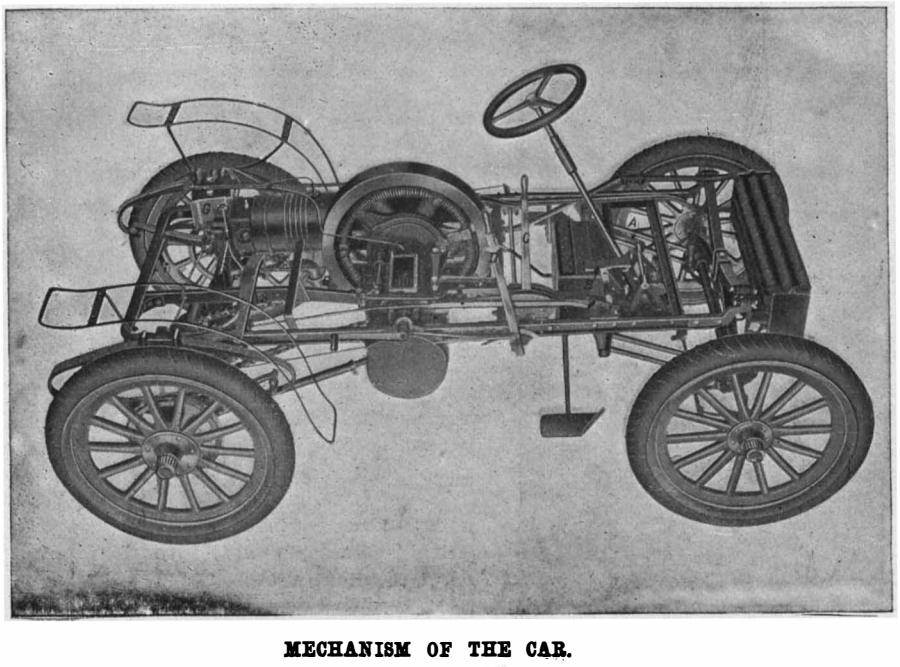
Fig. 2.—PACKARD CARBURETER.

The vaporizer, which is a modified Longuemaire of the float feed, pulverizing type, is shown at *F* in the carriage mechanism and also in section in Fig. 2. The gasoline contained in tank, *T*, which is fitted with gage glass, *L*, is led through a connecting pipe and the shut-off valve, *V*, to the bottom of the float chamber, *F*. The float in this chamber by means of a needle valve maintains the gasoline in the chamber and in the adjoining feed chamber at a constant level. The air for forming the gas enters the pipe, *R*, and passes upward through the small annular space *N'* around the spraying cone, *N*, drawing up the gasoline by its suction through very small grooves in the face of this mushroom-shaped spraying nozzle. Instead, however, of the passage for the inrushing air being open and of fixed form, it is limited at first to the small annular space by the bottom of the cylindrical air valve, *K*, which normally rests level with the top of the nozzle, *N*, as shown in the diagram. This valve is lifted by the suction of the motor, thus affording a larger entrance space for the air and at the same time causing holes in the upper part of the valve to register with similar holes in the wall of the mixing chamber. Through the passage thus opened, an additional supply of pure air is admitted to form the mixture. The amount of additional air which is thus admitted can be regulated by a hand-operated valve. The height to which the shifting air valve, *K*, is lifted is dependent entirely upon the strength of suction of the motor, and the speed of the incoming current of air past the gasoline jets is maintained approximately constant by the valve at all speeds of the engine, thus insuring an invariable mixture. Wire gauze baffle-plates arrest any possible unvaporized gasoline and complete the mingling process. The mixture passes directly to the back of the suction valve of the motor through the pipe, *M*.

The details of the ignition apparatus are one of the distinctive features of the Packard system. The ignition contact maker and controller or so-called governor is shown in the cut. Following the now universally adopted French practice, the ignition is by jump spark with a vibrator on the coil, but unlike other systems, the timing of the ignition is entirely under the control of a very simple automatic device. The primary circuit of the induction coil is at the proper instant closed between the platinum points, *P*. These points are brought together



THE PACKARD GASOLINE TOURING CAR.



MECHANISM OF THE CAR.

by the cam, *C*, coming in contact with the roller, *R*. The cam is of a spiral form and broader at one end than at the other. It is moved longitudinally on the shaft, *D*, as the speed varies by the throwing out of the governor weight, *G*. Thus when starting or running slowly the ignition occurs at or near the dead center. As the speed advances, the time of ignition is advanced ahead of the center. The adjustment is so timed that at any speed the ignition occurs at just the proper instant to give the maximum power and the maximum cushioning effect. Not only is great economy of fuel thus secured, but the greatest smoothness of operation is assured. As the ignition cannot occur ahead of the center in starting, there is no possibility of a dangerous back kick, and starting is exceedingly simple. When the maximum speed of the engine, usually 850 revolutions per minute, is reached, the cam, *C*, overruns the roller and no explosion occurs, so that an excessive speed of the motor cannot be obtained. This method of ignition regulation is a radical departure from the usual American method of throttling the mixture with fixed spark, and the French system of controlling the motor by hit-and-miss governing or by hand-regulated spark; and it unquestionably makes a distinct advance in the method of control of the engine.

Packard machines have given general satisfaction from the very start, probably because of the care given to details and the thorough testing each machine receives before it is sent out. The manufacturers aim to have the quality of their product always of the best, and no pains or expense are spared in fulfilling this aim. Four of their carriages won first-class certificates in the endurance contest last fall.

THE DURYEA GASOLINE CARRIAGE.

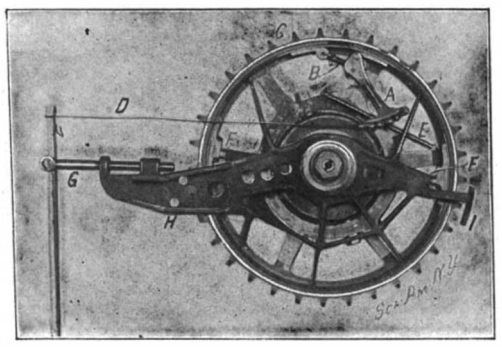
Our illustration shows the Duryea three-wheeled phaeton, which the inventor claims has many advantages over his regular four-wheeled machine, such as better traction, less liability to skidding, greater ease in steering and in making sharp turns, and numerous other good points he is always ready to demonstrate. This machine differs only from the regular model in having but one front wheel. Its mechanism is just the same as the latter, and consists of the following parts:

The motor, which has three 4½ by 4½-inch cylinders, develops from 6 to 10 horse power, according to its speed. One fuel pipe, *D*, supplies the three cylinders, the exhaust valves, *B*, of which are operated mechanically while the inlet valves, *C*, are opened by the suction of the piston and can be limited in their opening by the tapered slide, *F*, which is suitably connected through the lever, *G*, and the rack, *H*, to the controlling handle. When the handle, *R*, is turned a wide pinion on the lower end of the sleeve turns with it and moves the rack, which acts through its lever connection, *G*, to slip the slide, the springs under the inlet valves thus keeping them from opening and throttling the motor. The spring fingers attached to the slide slip over the inlet valve and relieve compression when the motor is started. The gasoline is vaporized in a float feed carbureter of the atomizing type, situated below the controlling handle, and having a needle valve capable of being set from the seat by turning a spindle that is level with the latter beside the controller. Contact igniters are used, and the wiring is all plainly to be seen, as well as the spark coil in the corner. A belt-driven magneto at *N* supplies electricity for the spark.

The clutches are contained in the drum at the left of the motor. They furnish the usual two speeds ahead and one reverse. The high-speed clutch locks the whole mechanism to the motor shaft and leaves no gears running. The low speed and reverse are obtained by one set of planetary gears. To obtain the former a band brake holds the internal gear and the spider on which the pinions are mounted revolves at a slow speed and turns the driving sprocket. To obtain the reverse the pinion spider is held and the internal gear is connected to the sprocket. The slow and fast speeds are obtained by pushing down or pulling up the controlling lever, which acts on the clutch lever, *K*, while a foot pedal tightens the band brake, *L*, for the reverse.

The controlling lever steers the carriage when pushed to the right or left, owing to its two levers being connected by chains to the steering arms of the wheels. Thus it will be seen that the machine is completely controlled by a single lever, and this with the greatest ease by but one hand, except when throwing in the clutches, which requires the use of both hands. As the motor is amply powerful to drive the machine on the high gear, however, the low-speed gear seldom has to be used, and the speed of the carriage is controlled solely by throttling the motor. This method of control, in combination with the triple-cylinder motor, gives great flexibility to the carriage. The vehicle can be suddenly brought from full speed almost to a stop by a slight twist of the wrist, and when it seems as if the motor must cease to turn unless thrown out of gear it can be sped up again instantly by a twist in the opposite direction.

The new form of band brake is of the expanding type, and acts on the inside rim of the sprocket on the differential gear. It brakes on a 14-inch drum, ⅞ inch wide. The ends of the band are separated by a lever, *A*, hinged at one end and carrying a band in which an adjusting screw, *B*, is threaded. This is swiveled in the hinge, *C*, on the other end of the band, so that a forward pull on the end of the lever, *A*, expands the band and makes it bind against the inner surface of the sprocket. The pull is transmitted from a brake lever at the front of the carriage to the lever, *A*, by means of a small flexible wire, *D*. The lever, *A*, has an arm projecting at such an angle that the spring, *E*, gives a powerful pull when the brake is nearly off and has less effect as the brake is applied. By this arrangement and the arrangement of the toggle a very slight pressure will expand this brake quite forcibly and ordinarily slip the wheels on the ground. The large friction surface contributes to long life and lessens the danger from overheating on a long hill. The band is of metal lined ordinarily with gray vulcanized fiber. This band is supported by two lugs, *F F*, one in front and the other behind, which fit loosely in elongated eyes attached to the band. From this construction it will readily be seen that the braking effort is taken on the bottom side of the lug farthest from the brake lever in the line of motion, and since the lugs are at about 90 degrees from the brake lever, three-quarters of the brake band tends to apply itself, the friction on the end of the band assisting the push of the brake lever. This action is the same whether the motion is forward or backward. The method of support secures a brake nearly self-applying, and much lessens the effort required to stop the vehicle. If more self-applying effect were desired the frames supporting the lugs, *F F*, could be so shaped as to bring them nearer the brake lever, and thus make a greater proportion of the brake self-applying. In addition to the lugs, *F F*, on the frame or spider there are five other points or fingers which prevent the brake band from coming off at one place more than at another, and thus insure an even release all the way around, making an effectual safeguard against dragging, so common with most band brakes. Perhaps no other feature of a motor vehicle contributes so largely to lost efficiency as the dragging of the band brake, and a little attention to the fingers provided for holding the band in place effectually prevents this happening with this brake. The frame is also provided with a projecting forward end in which is screwed a rod, *G*, used to adjust the tension of the chain. In practical service both the chain and sprocket are covered with a leather guard supported on a framework secured to the frame shown by the screws, *H*, and the lug, *I*, in which screws are also placed.



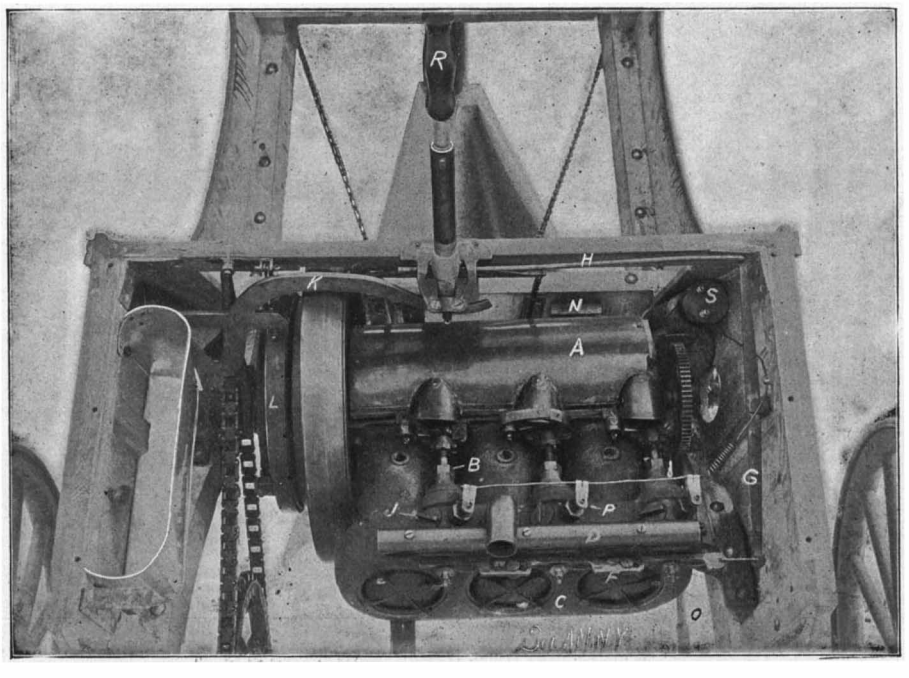
DURYEA BRAKE.

The differential gear is of the bevel variety and is placed inside the large sprocket. It has four bevel pinions which, together with a central bearing, properly support the sprocket and effectually transmit the power.

From the above description it will be seen that the Duryea is a simply constructed carriage with a well-built, reliable type of motor. The latter is so situated that it can instantly be got at by removing the seat and front panels, and any necessary adjustments can be made without getting out of the vehicle. Built into the back of the latter is a water tank, and under the floor a gasoline tank is placed. The carriage is strong yet light, weighing about 800 pounds.

The Duryea motor has been successfully used in launches as well as in automobiles. A 22-foot boat equipped with one was found to develop a speed of 12 miles an hour in the Hudson River last spring; and launch users generally will find it a very suitable motor for light, high-powered pleasure craft.

THE DURYEA GASOLINE CARRIAGE.



DURYEA THREE-CYLINDER AUTOMOBILE ENGINE.

The King as an Automobilist.

The third motor vehicle constructed on the order of King Edward is being built at the works of the Daimler Company at Coventry. This royal vehicle is a pattern of safety and elegance. It is, according to The Sketch, the model motor of 1902—a fitting car for the coronation year. A couple of cars were built last year to the King's order, and he is so satisfied with the performances of these that he has ordered the third, and it is stated that he will be seen driving this one himself.

A gentleman connected with the household tells an interesting story of how the King was cured of an obstinate and long-standing case of insomnia by the simple expedient of taking an after-dinner spin in his car. When his friends ask him for his prescription for sleeplessness he invariably laughs and answers, "I advise you to take some large doses of Daimler."

A great wave of automobilism has passed over the country, and nobody can claim to belong to the smart set unless he has a motor in his stable. Royalists are beginning to follow the Kingly example, and insist that their vehicles shall be of English construction. Continental cars were for a short time fashionable, but many of these were found flimsy and unsatisfactory in the wear.

The general feeling in England is opposed to racing and record breaking or law breaking. Space annihilators and time pursuers are not altogether in harmony with British views. No particular object is served by a mile-a-minute demon. What is in most demand is a comfortable car for locomotion, social purposes and pleasure making.

The Cornwall Canal in Canada is lighted by 250 inclosed arc lamps, placed 300 feet apart, and the locks are lighted with a number of lamps.

Electric Vehicles

THE AJAX ELECTRIC RUNABOUT.

Light electric runabouts arranged to carry two persons have, within the past year or two, become very popular, especially on account of their simplicity, perfect control while in motion, convenience in manipulation, certainty of operation, inexpensiveness of maintenance and minimum degree of care required.

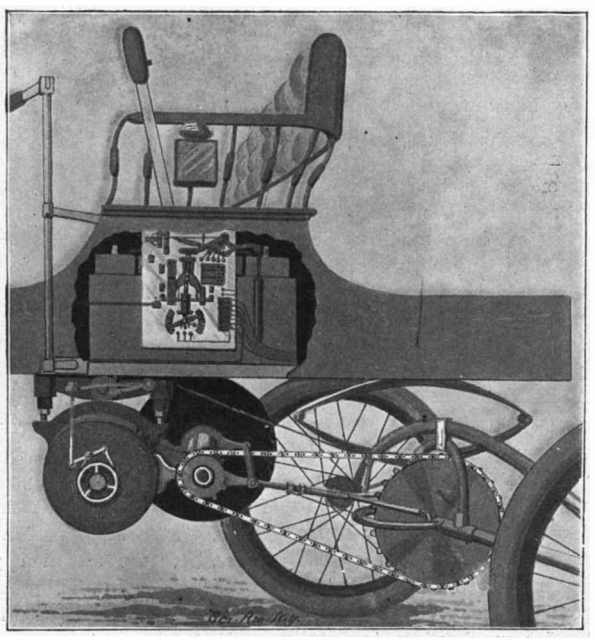
The vehicle shown in our illustrations is an improved type of runabout, designed to be of light but strong construction, capable of being handled without appreciable effort, and is economical in operation. It has been recently introduced by the Ajax Motor Vehicle Company, 220 West 36th Street, this city, and practical tests have demonstrated its durability and usefulness. The complete vehicle in operation is shown in one illustration, while the other exhibits two features of special construction that are new, and which are protected by American and foreign patents. One is the manner of hanging the motor by a hinge or flexible joint from the bottom of the wagon, having rubber or spring cushions on either side of the hinge, which gives to the motor a certain resiliency when the current is applied that relieves the back axle from undue strain. The other feature is the improved controller operated by the handle on the left of the seat near the lamp. In the portion of the body broken away are to be seen the storage batteries under the seat and in front, a slate slab supporting the controller switch. In general terms, as the power handle is moved from a vertical position either forward or backward raises the contact inverted Y central metal yoke switch until it makes contact with the flat spring fingers on the right for three or four different speeds. At the moment of contact a supplemental horizontal bar carrying carbon contacts on each end follows upward the Y-shaped piece and temporarily closes the circuit through same, thereby preventing sparking at the ends of Y main controller switch and prevents the burning or destruction of the metal contacts. A rod extends downward from the center of the Y contact switch into a solenoid and is in contact with a separate armature piston operating within the solenoid, having its lower end pivoted to a lever controller below, which in certain positions reverses the direction of the current. A small portion of the battery current is shunted through this solenoid coil when it is desired to make the solenoid armature piston follow the movement of the main switch rod. If the power handle is moved backward from a vertical position, bringing the controller at the bottom into adjustment for a reversal of the battery terminals, the motor will still move forward until the smaller switch button projecting outward from the handle is pressed inward, then the current is reversed and the vehicle moves backward. So that no matter what position the handle is in, the motor will rotate in a forward direction until the small handle reverse button is pressed.

The forward hinged handle is for steering, and on the motor armature shaft is arranged a simple brake to be applied there as well as a band brake to be applied in the rear, both of which are very effective. Behind the motor is the aluminium-cased gear wheel into which the motor pinion meshes, and from the sprocket pinion on the gear wheel shaft runs the sprocket chain to the rear axle sprocket driving wheel. A special brace rod forked at the rear end is located between the sprocket pinion and rear axle for the purpose of keeping the sprocket chain taut.

The tubing composing the running gear is of the best quality, and the wire wheels are equipped with durable pneumatic rubber tires. The weight of the vehicle holding twelve cells of storage battery is about 1,000 pounds. It has the usual volt and ampere meters. There is considerable storage room back of the seat, as the batteries only occupy the space under the seat.

The vehicle, as a whole, has a very attractive, neat appearance and, being comparatively light, will, on smooth roads and medium grades, travel a long distance on one discharge of the battery.

AJAX RUNABOUT.



AJAX RUNABOUT MECHANISM.

THE HOUSEBOAT "RANCOÇAS."

The original houseboat was not, as its name would seem to indicate, a floating home intended for travel by water. Indeed, as built and used in England today there is much more house than boat about the craft, the structure consisting merely of a kind of floating barge or dock, with living accommodations built upon it, which is moored in some quiet water, and is never intended to, and very rarely does, move from its first anchorage. The annually recurring aquatic festival at Henley-on-Thames, which has furnished so many subjects for the artist's brush and the camera, has rendered the outside world fairly well familiar with the English houseboat. The "boat," or scow, as it should more strictly be called, is generally a square-ended, shallow structure whose first and last purpose is the supporting of a structure, usually one story in height, which is divided up into the living and sleeping accommodations of the owner, the roof, or upper deck, being usually canvased over and tastefully decorated with shrubs and flowers.

When the houseboat was introduced into this country it was inevitable that it should receive considerable modification. The first and obvious change was to make it more worthy of its name, and give it some of the mobility which is lacking in its Englsh prototype. The square-ended scow hull gave place to a hull that was more entitled to the term "boat," and the change was made without detracting in any way from the purposes and uses of the houseboat as such. By giving the hull a shapely bow and stern and ample rudder control the craft became navigable at once, and capable of being taken in tow or moved by her own engines, not merely between closely adjacent seaside or river resorts, but over distances of, if need be, several hundred miles.

As illustrating a first-class houseboat of this type we present the accompanying views of the "Rancocas," owned by Thomas Dolan, of Philadelphia. The vessel was designed by the well-known firm of Messrs. Tams, Lemoine & Crane, of New York city. The length over all is 108 feet; waterline length 100 feet; the beam, 17 feet 6 inches; and the draft, 2 feet 6 inches. The shallow draft adapts the boat for the shoal waters which are found in bays and estuaries and the shallow rivers of the South. Over the deckhouse is an awning deck provided with frames suitable for stretching an awning for use in summer weather. This gives an unbroken promenade or lounging place, some 85 feet in length by 17 feet in width.

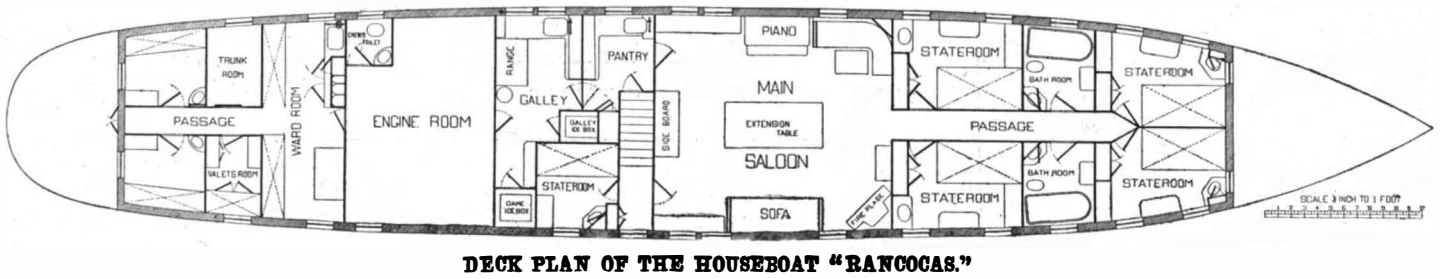
In the forward deckhouse are four bedrooms, with a bathroom serving each two rooms. Then comes the main saloon, which is about 18 feet by 16 feet, and is arranged as in a house on land, with open fireplace, bookcase, sideboard, divan, piano, writing desk, dining table and reading table.

Aft of the saloon, on one side, is a room with two berths for maids. On the other side is a commodious pantry, between which is the companionway leading to the upper deck. Next to the pantry is the galley, aft of which comes the machinery space; while in the extreme after end of the boat are the officers' quarters. In the officers' quarters there are rooms for the valet and a trunk-room. There is also a separate iceroom for the storage of game, and a gunroom.

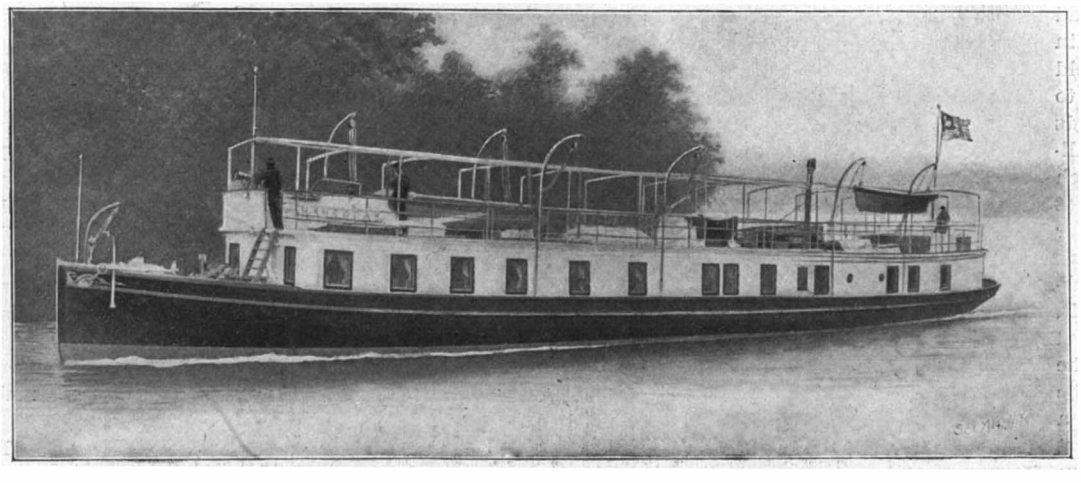
The vessel is lighted by electricity, and is heated with steam heat throughout.

The motive power consists of two 75 horse power gas engines, which drive the boat at a speed of about ten miles an hour.

The finish below is plain and substantial, the walls being white enamel finish, and the furniture mahogany. The main saloon is finished in so-called Colonial style, with open fireplace with tiled hearth. The floor of the main saloon is hardwood, a rug being used instead of carpet. That the "Rancocas" is a seaworthy craft has been proved by her successful and lengthy tours in Southern waters.



DECK PLAN OF THE HOUSEBOAT "RANCOCAS."



Length over all, 108 feet. Beam, 17 feet 6 inches. Speed, 10 knots.

THE HOUSEBOAT "RANCOCAS."

On Tuesday evening, February 11, Dr. S. Sheldon, of the Brooklyn Polytechnic Institute, gave an experimental lecture before the Automobile Club of America on "The Storage Battery." Dr. Sheldon discussed electrolytes and showed by means of a galvanometer projected on a screen by a stereopticon, how the resistance of these fluids decreases when they are heated, and they act just the opposite of an ordinary conductor. Some views were shown of a few representative cells of American make, and a sample Edison cell was also exhibited as well as a discharge curve of the first discharge from the first machine-made Edison cell, which has just been completed.

The fuse in one of the motors on the Liverpool Overhead Railway burnt out a short time ago while in a tunnel. Fire was communicated to the car, which in turn ignited some piles of creosoted ties which, for some inexplicable reason, were stored alongside the track. The result was a serious conflagration, and several employés of the road were killed.

TWIN-SCREW HOUSEBOAT DESIGNED FOR THE LATE PIERRE LORILLARD.

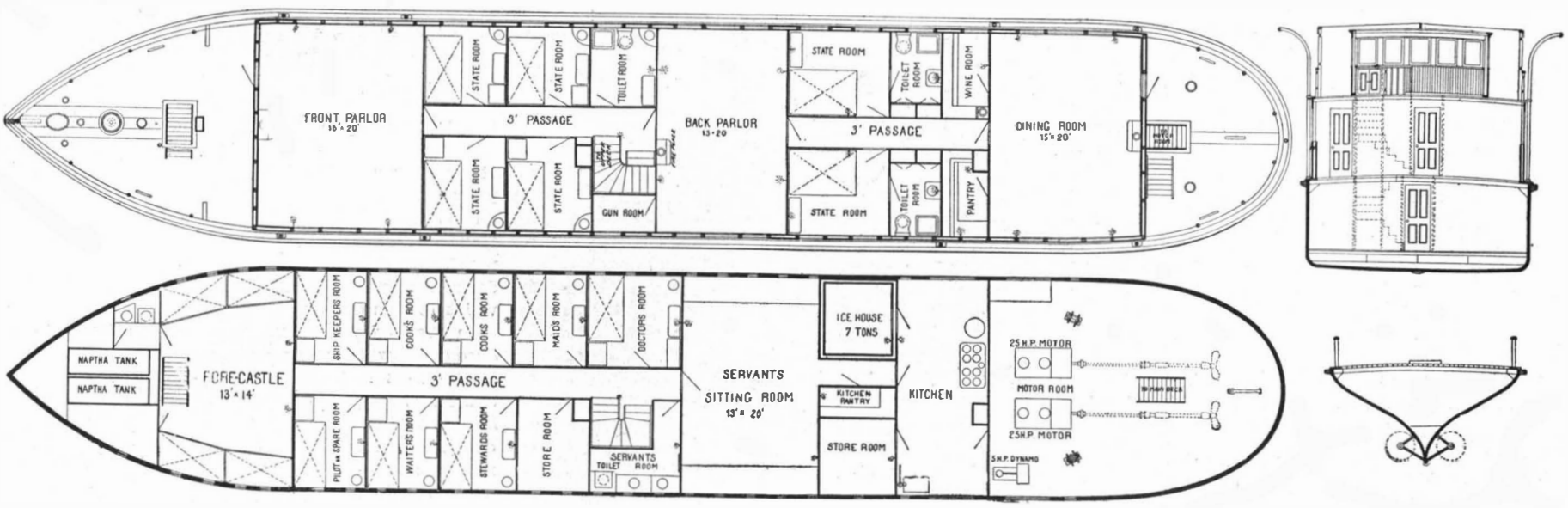
What might be called the first stage of improvement in houseboats over the English type consisted in giving a true boat model to the hull, thereby enabling the vessel to be readily towed to any desired location. From this improvement it was a natural step to render the houseboat independent of the towboat and give it its own motive power. Of the owners of houseboats in this country, there was none more qualified to determine what was the most convenient arrangement than the late Pierre Lorillard. The handsome boat shown in the accompanying illustration was designed for him by Messrs. Tams, Lemoine & Crane, naval architects of New York city. The total length over all is 125 feet; the length on waterline, 119 feet 6 inches; the extreme beam, 23 feet 4 inches; and the draft, 2 feet 6 inches. The hull is built of steel and the upper works of wood. The motive power consists of two 25 horse power Maurray & Tregartha gasoline engines, with two copper tanks of 350 gallons capacity each. The engines drive two four-bladed, right and left, gun-metal propeller wheels, each 34 inches in diameter, and under favorable conditions the boat is capable of a speed of 6½ to 7 knots per hour.

There are three decks, the lower, main and upper. On the lower deck, beginning forward, are chain lockers, naphtha tanks in a separate compartment, two storerooms and a toilet room for the crew; aft of these is forecastle, 13 feet long by 14 feet wide. Then follow seven rooms, each 7x9, for the officers and servants; a room 9 feet 3 inches by 9 feet for the doctor, and a storeroom 7 feet by 9 feet. Aft of this, on one side, is the ice house, 9 feet by 7 feet, with a capacity of 7 tons of ice, and on the other side the kitchen pantry and a storeroom 7 feet 10 inches by 7 feet 6 inches. Aft of this is the galley, 9 feet wide by 20 feet long; aft of which, occupying the rest of the space aft, is the motor room.

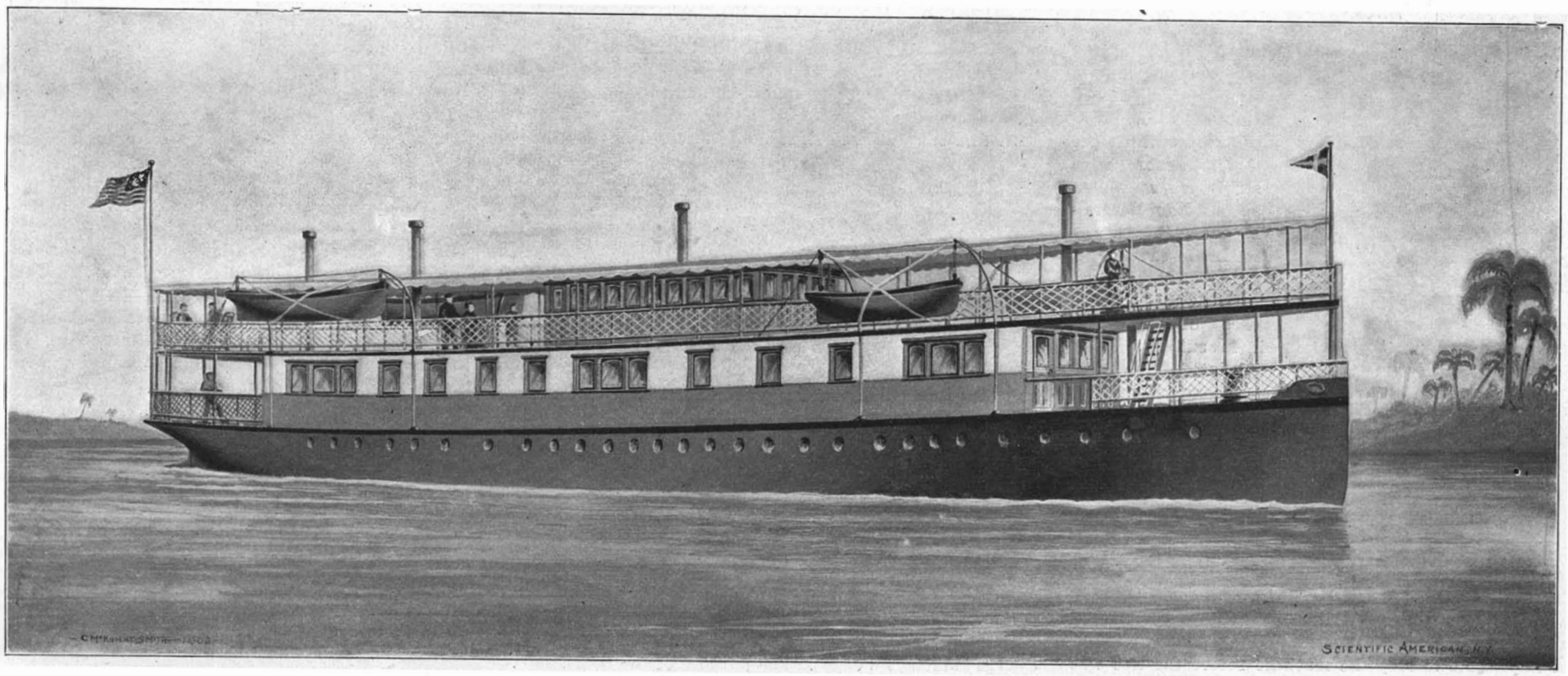
On the main or berth deck, again beginning forward, are an open deck space 24 feet long, on which are the capstan, filling and vent pipes to the naphtha tanks, the companion to forecastle; a deckhouse 87 feet long and an after deck 14 feet long, on which are the companion to motors, the towing cleats, and a stairway to the upper deck. At the front of the deck house is the forward sitting room measuring 16 feet by 26 feet, in which is an open fireplace. Aft of this spacious room are four staterooms, each measuring 8 feet by 7 feet 9 inches, a toilet room 6 feet 3 inches by 7 feet 9 inches, a gunroom 6 feet by 3 feet 6 inches, and a stairway to the upper deck. Then follows another spacious sitting room, also provided with a fireplace, the dimensions of the room being 13 feet by 20 feet. Aft of the sitting room is a 3-foot passageway, on either side of which are two staterooms, 10 feet by 8 feet 6 inches, two toilet rooms, a pantry and a wineroom; and at the end of the deck house is a dining room 15 feet by 20 feet provided with an open fireplace.

The upper deck extends the whole length of the vessel, 126 feet, and for the full width of 23 feet. It is covered by an awning which is stretched on ridge poles and supported at the side stanchions by struts.

In the middle of this deck is the observatory, 25 feet long by 13 feet 6 inches wide, which is provided with companion and dumbwaiter to the owner's quarters. There is a stairway at the forward and after end, leading respectively to the forward and after open deck spaces. Taken altogether, with her great size, generous accommodations and serviceable speed, this boat is a fine representative of the thoroughly up-to-date development of the modern houseboat.



DECK PLANS AND SECTIONS OF THE PIERRE LORILLARD HOUSEBOAT.



Length over all, 125 feet. Extreme breadth, 23 feet 4 inches. Draught, 2 feet 6 inches. Speed, 7 knots.

THE LORILLARD HOUSEBOAT.

Storage of Fuel.

The question of the storage of his fuel is one of the most serious questions which confronts the owner of a gasoline automobile. It must needs be stored around in more or less generous quantities, and when kept within a building there is always risk as well as increased insurance charges. In order to meet these emergencies a cabinet has been devised and manufactured by S. F. Bowser & Company, of Fort Wayne, Ind. It consists of a construction of galvanized metal standing about seven feet high. The lower half contains the gasoline, while the upper part contains the pump, access to the latter being secured through a drop door. The pump is supplied with a measuring device, by which it is possible to accurately gage the amount of gasoline, thus preventing overflow and waste.

Bicycle Club's Automobile Stables.

The storage, care and repair of automobiles is developing into quite a business, especially in the larger cities of the country. The majority of motor-vehicle owners who live in the closely-built-up sections have not the facilities or the time to devote to the proper care of their machines, and as a consequence "automobile stations" are multiplying rapidly. One great disadvantage, however, is that these stations are usually located in the business sections of the city, at a distance from the residences of the owners of the vehicles, thus necessitating a long ride in the trolley cars before a trip can be undertaken.

It was this state of affairs which induced the Century Wheelmen, the crack cycling organization of Philadelphia, if not of the United States, to transform a portion of its immense wheel-room into an automobile station. This has resulted not only in a considerable increase in annual receipts, but in a large accession of uptown automobilists, who embraced the opportunity of securing storage and repair facilities for their machines much nearer home and at less expense than similar conveniences could be had downtown. This mutual benefit will doubtless result in similar experiments elsewhere, the larger bicycle clubs throughout the country, many of which have been in financial straits since the decline of cycling as a sport, being peculiarly adapted to the purpose, having in the majority of cases large wheel-rooms which are now practically unused, and, besides, possessing well-furnished club houses with locker-rooms and the bathing facilities so necessary after a long trip with its consequent grime and dust.

The example set by the Century Wheelmen will doubtless be followed by many other cycling organizations throughout the country. Indeed, it is in the nature of things that organizations and individuals interested in good roads should work together. Why should they not live together?

Yacht builders on the Thames complain that the automobile is making inroads in their business. This is due in a measure to the fact that automobiles are somewhat cheaper, but mainly to the greater freedom of travel.

Automobile Tires

One would suppose that, after the experiments and tests made in the manufacture of bicycle tires, there would be little room for invention in automobile tires. This is not, however, the case. The latter tire, on account of the weight which it sustains and the strains to which it is subjected in rapid traveling, must be more heavy and more securely fastened to the rim. At the same time it must be capable of a certain degree of emergency repair in case of puncture. These requirements have been met in a number of inventions, and it is interesting to note that, while in the automobile, as in the bicycle, solid tires have been practically discarded in favor of single and double tube tires, yet there is this difference, that the single tube tire has taken precedence in bicycles, whereas the present tendency is to favor double tube tires for automobiles.

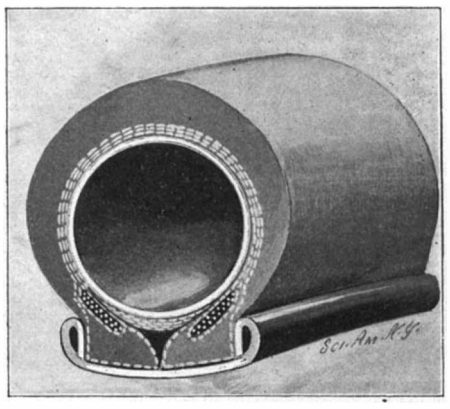


Fig. 1.—Double-Tube Tire with Woven Wire Clinch.

In our first illustration we have a double tube tire of the clincher type. The inner tube is protected by an outer tube or casing having a U-shaped cross-section and made of interlaid rubber and fabric. The retaining device consists of two strips of woven wire embedded and vulcanized within the casing. These wire strips are so woven as to expand laterally when the tire is inflated, causing a powerful contraction in the circumference of the tire. This contraction, it is claimed, is sufficient even when the tire rim is partly deflated, to hold it tightly against the rim without the use of lugs or cement. In case of puncture it is an easy matter, the tire of course being entirely deflated, to pry out one side of the casing in the region of the puncture, thus giving free access to the inner tube. After the repairs are made and the casing snapped back into place, it is only necessary to inflate the tire, and it will be ready for use.

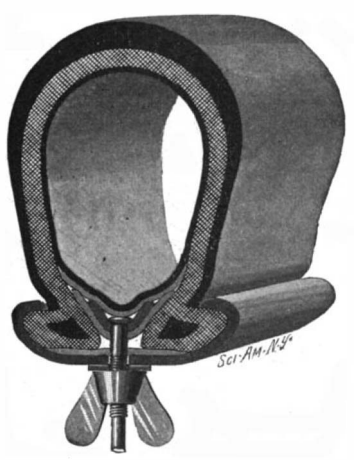


Fig. 2.—Double-Tube Clincher Tire with Locking Bolts.

Some manufacturers claim that a tire needs to be fastened to the rim just as securely when deflated as when inflated. The point is a good one, for in case of a bad puncture when running at high speed, it might be impossible to stop the machine before the tire was entirely deflated; in which case, unless it was securely held, it would probably slip off, exposing the rim to injury.

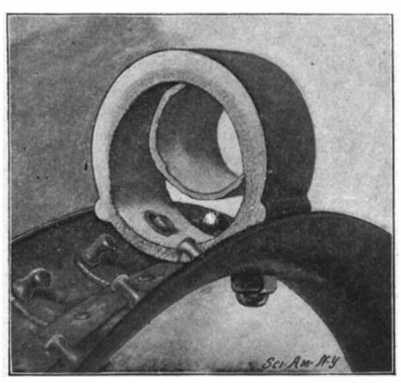


Fig. 3.—Double-Tube Tire; Outer Tire Buttons to Rim.

Fig. 2 shows a tire designed to prevent such results. It is similar to Fig. 1 in cross-section, having along each edge of the outer casing a strip of hard rubber, embedded in the structure, and forming a stiff and substantial rib. At frequent intervals along the rim are the fastening devices, which consist of a metal plate, with a bolt passing through it and projecting through the rim. On this bolt is a thumbnut, which is adapted to bear against the under surface of the rim and draw down the plate against the inner edges of the casing. This acts as a wedge to distend these edges and force them under the overlapping lips of the rim. The plate and bolt head are incased in a layer of canvas and one of soft leather, in order to prevent injury to the inner tube. In case of puncture, it is only necessary to unscrew the thumbnut nearest the injured part, until it drops over the reduced portion of the bolt, when the casing can be easily pried out and the inner tube repaired.

Fig. 3 shows a tire which buttons onto the rim. In this case the rim is provided with a metal band, secured thereto at several points. On the band are two opposed series of hooks, whose claws project inwardly toward the center line of the rim. These hooks are adapted to enter and engage their respective eyelets, which are disposed along each edge of the casing. This arrangement insures a secure hold along the entire circumference of the tire, and it can be unhooked only when deflated.

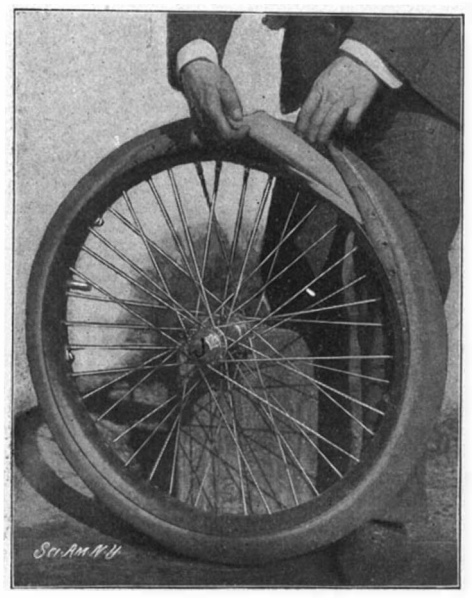


Fig. 4.—Removing Inner Tire.

Fig. 4 shows this tire unbuttoned and the inner tube exposed and ready for repairs.

In Fig. 5 we have another double-tube tire, which is secured by merely inflating it. Like the other tires mentioned the casing is constructed of rubber and fabric in layers; but it contains endless rings of wire on each side along its edges. The purpose of the rings, as in the first case described, is to insure a stiff binding to the edges; but with this difference, that the wire will not stretch, and consequently one is immediately confronted with the problem of how the tire is slipped on or off the rim, since the circumference of the wire rings is smaller than that of the edges of the rim. This problem has been cleverly solved by molding the rim with a depression or channel midway between its two edges. Now by squeezing together the wired edges of the deflated tire and pressing them down into this channel along one-half of the rim, sufficient slack is produced along the opposite arc to allow it to be slipped over the rounded edge of the rim. The inner tube when inflated tends to spread the wired edges out of the center channel, up the inclined surface of the rim, and into their proper positions against its side walls.

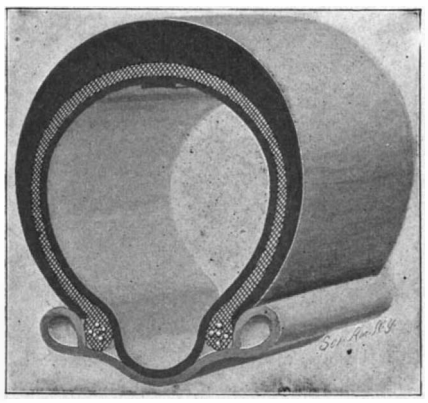


Fig. 5.—Double-Tube Tire with Endless Wire Clinch.

In Fig. 6 we have a single tube pneumatic tire which is so thick as to serve as a solid tire in case of puncture. It is made up of layers of tough rubber and closely woven canvas, and it seeks to avoid puncture by the thickness of its walls, as well as the quality of structure. This permits but a slight flattening in case of puncture and it can consequently be used for a considerable distance in this condition, without danger of injury from rim cutting. The tire is secured to the rim by a number of lugs, preferably one to each spoke in the wheel, to prevent any possibility of the tire's creeping. These are embedded in the structure, and consist of a flat head and a hollow shank, projecting through the rim of the wheel. A stud is threaded into each shank, and the tire is then locked securely to the rim by the nuts, on these studs, which are screwed against the under surface of the rim.

We have shown in Fig. 7 another attempt to produce a non-puncturable tire. This also is a single tube tire.

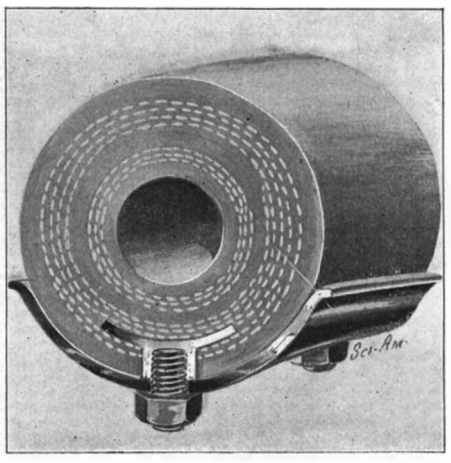


Fig. 6.—Single-Tube Tire, Showing Method of Attachment.

It contains a strip of chemically treated fiber which protects the innermost layer of rubber. This fiber acts, on the principle of bullet-proof cloth, to oppose the entrance of any penetrating object. It is also water proof, and thus prevents moisture from reaching and deteriorating the delicate innermost layer of rubber, which retains the air.

In Fig. 8 we see a very successful attempt to produce a tire which while not pneumatic, yet is very resilient. This is effected by a honeycombed elastic core, made somewhat on the principle of a truss bridge. The core is molded in halves, which are vulcanized together and then surrounded by layers of rubber and fabric, the whole tire being thus vulcanized together. Our illustration shows a tire which has had four thousand miles of wear.

Fig. 7.—Non Puncturable Tire with Layer of Fiber.

A unique and entirely practicable safety stop for electric vehicles is that of Arthur L. Stevens, of New York. It is designed to prevent the running away of the vehicle should the operator by accident be thrown from his seat or should the ordinary current controller of the vehicle become accidentally deranged. The operator's seat is hinged at the front, the rear part being movable upward by a spring placed between the frame and a lug or projection on the seat. The weight of the operator on the seat presses a vertical pin which completes a circuit, the reverse process breaking the connection. The vehicle is thus incapable of operation unless the operator is firmly installed in his place.

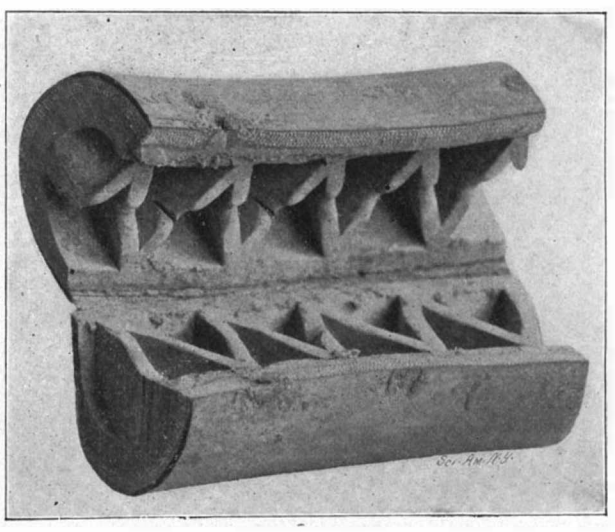


Fig. 8.—Tire with Rubber Truss Reinforcement.

Figures compiled in Paris show that 82 per cent of the road accidents of France are due to horse-drawn vehicles, 8 per cent to railroads, 5 per cent to bicycles and 5 per cent to automobiles.

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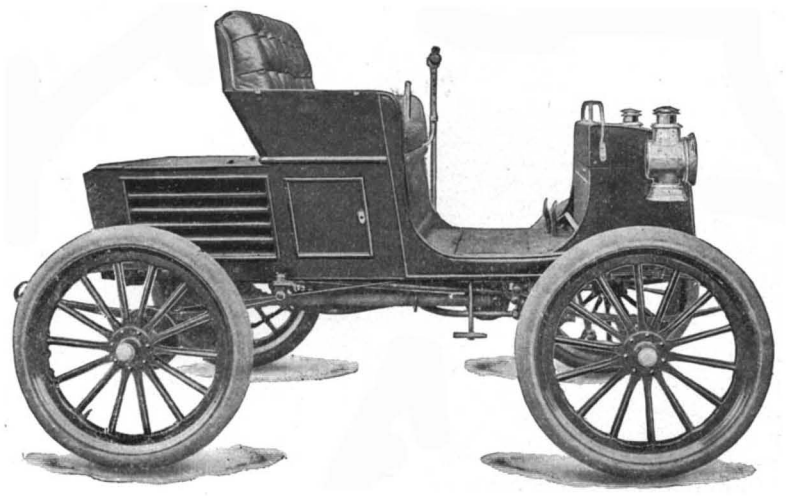

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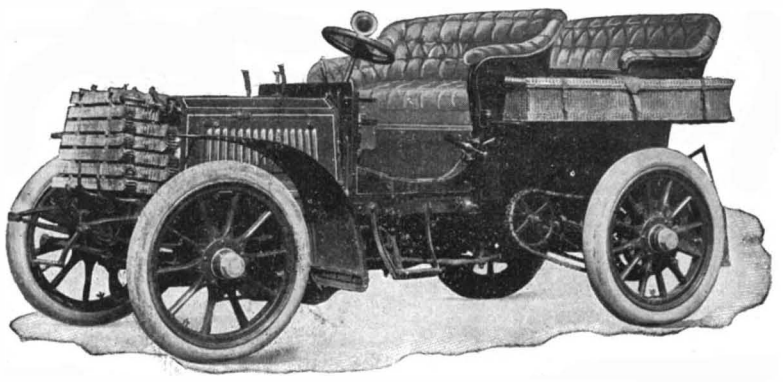

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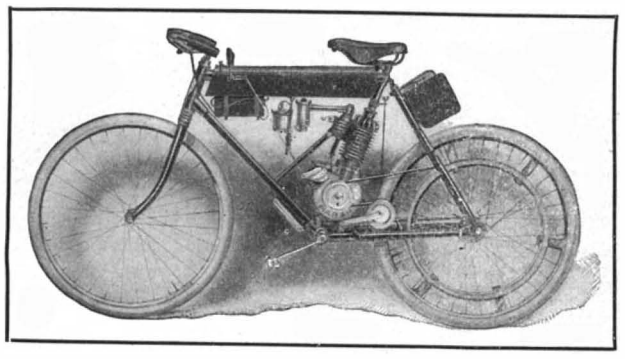

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One of the points covered in our guarantee is that we will refund money if our machine fails to carry a rider weighing 175 pounds a mile in 2 minutes or up a grade of 10 per cent. at 10 miles an hour.

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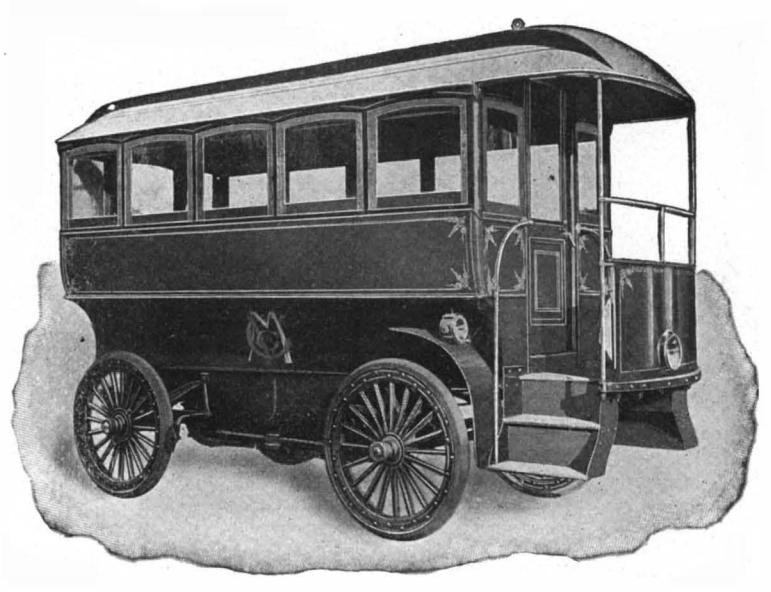

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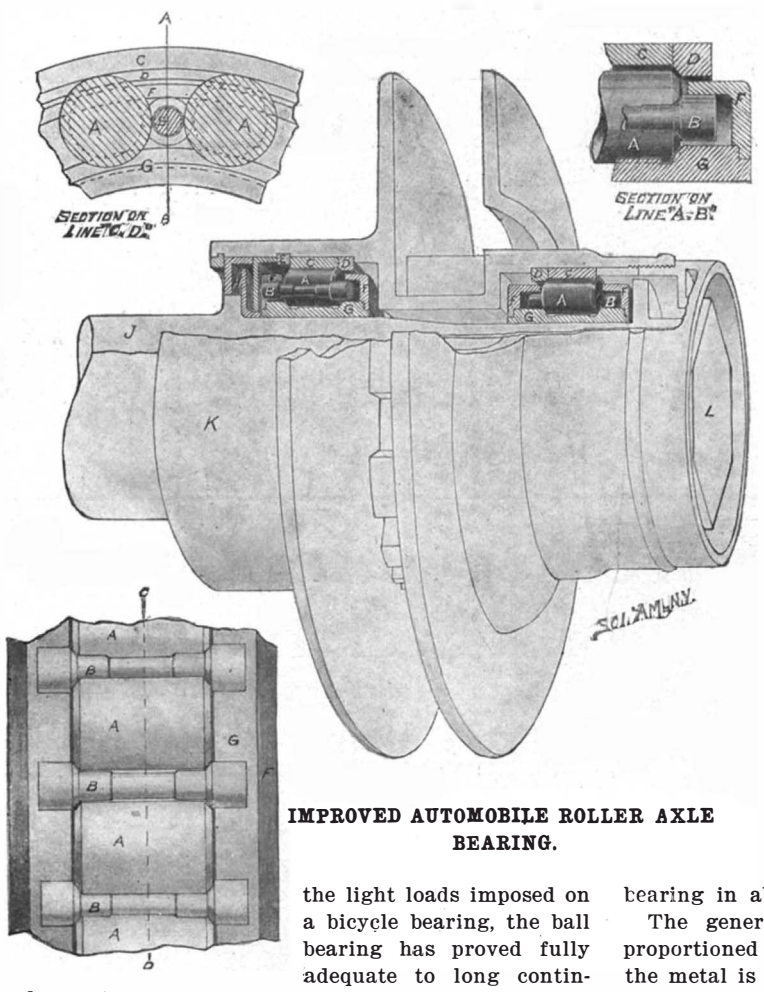
AUTOMOBILE ROLLER AXLE BEARINGS.

The simplest and oldest form of bearing is undoubtedly the plain or parallel axle bearing. It is as old as history itself, and we might be using it yet had it not been for the advent of the bicycle. The writer of the present article well remembers how, in the late seventies, he rode machines that were successively equipped with the plain parallel bearing, the cone bearing, the roller bearing, and finally the single and double ball bearing. Each of these sought to improve upon the original parallel bearing by reducing friction and providing a means of periodically taking up the wear. The plain and the cone bearings were subjected to rubbing friction, the roller and ball bearings to rolling friction. For reasons which will be subsequently explained, the early roller bearings were a failure and soon ceased to be a serious competitor to the ball bearing, which at once proved its absolute superiority to any other type for use in bicycles.

It is not necessary here to demonstrate the superiority of a rolling over a rubbing friction in bearings; and were the question of a perfect bearing a question of friction merely, the ball bearing would stand to-day as the perfect bearing for every conceivable class of work. There are, however, other elements which are of vital importance, especially in bearings intended to carry the heavy loads and be subjected to the violent shocks which are imposed in the modern automobile. We refer to the question of wear and adjustment. As regards the wear, while it is true that under



IMPROVED AUTOMOBILE ROLLER AXLE BEARING.

the light loads imposed on a bicycle bearing, the ball bearing has proved fully adequate to long continued service, when it comes to be subjected to the extremely heavy loads and severe shocks encountered in the automobile, to say nothing of heavy truck or railroad car service, it is found that much larger bearing surfaces are necessary than are provided by the limited contact surface between the ball and its race. Hence it was natural that in searching for a type of bearing which would give this increased bearing surface, inventors should take up, once more, the discarded roller bearing of bicycle days and endeavor to adjust it to modern conditions. Here, apparently, was a complete solution of the problem of adequate bearing surface, and the new types of roller bearing were put upon the market with every confidence that they would meet the conditions of low coefficient of friction combined with adjustability and endurance. It was found, however, that there was a new and unsuspected weakness in the roller bearing, which has proved to be really the most troublesome defect of all. We refer to the necessity of maintaining absolute parallelism between the rollers. It was discovered that if the bearings lost their parallelism they would lose their line contact, and would bear at their center on the inner race and at their ends against the outer race. Under these conditions a heavy cross-bending strain was brought upon the rollers and they were frequently broken. It was found that it would not do merely to place the rollers side by side and trust to their wearing evenly and maintaining parallelism unassisted. Some device for maintaining them in accurate parallel adjustment was essential. So true is this that it is recognized to-day among the makers and users of this type of bearing that the best bearing is the one which has the best method of control. Moreover, it is scarcely less important to provide some form of separator, otherwise the adjacent surfaces of rollers, since they rotate in opposite directions, will exert a rubbing friction against each other that would defeat the very object of the bearing. Many devices have been adopted for guiding the rollers, among which may be mentioned the use of end slots, cages and pivots mounted in cages. Some of these have considerable merit and have stood the hard service of several thousand miles of work; but they all show more or less weakness in the tendency of the cages to wear away, letting the rollers get out of adjustment, and in the liability of the cages to break under the twisting strains that are brought upon them. There is also a certain amount of friction due to the rotation of the rollers in the cages themselves.

The very interesting roller bearing herewith illustrated, which is manufactured by the American Roller Bearing Company, 32 to 40 Binford Street, Boston, Mass., has been designed with a view to satisfactorily solving this problem of control. It seeks to get rid of the rubbing friction which is ultimately fatal to the roller cage, and to provide a system of separation and control which will not only obviate friction, but which will keep the rollers at all times absolutely in parallelism. We present several views of the details of this device, and also a sectional view of a wide axle bearing, in which two of the standard bearings are used, one at each end of the journal. The bearing consists of a series of large rollers, *A*, separated by smaller separating rollers, *B*, which are mounted between the centers of the main rollers, and serve to prevent them from coming in contact. These separators which, like the main rollers and the races, *C* and *G*, are made of hardened steel of high tensional strength, have rolling supports at their ends, this support being afforded by the retainer caps, *F*. The enlarged ends of the separators bear on the races in these caps and are so proportioned that they travel around in perfect harmony with the main rollers without slipping or dragging. Even at the slower speeds, centrifugal force keeps the separating rollers in contact with the retainer caps, so that they have no bearing on the sleeve. At the same time this inner sleeve prevents them from dropping out of place when the speed is too slow. Now, it will be noticed that instead of utilizing the cages ordinarily used, the main rollers, *A*, are kept in place by their beveled edges bearing against the beveled enlarged ends of the separators. Before any given bearing could get out of lateral adjustment, or swing around out of parallel with the axis of the bearing, it would have to stretch and break the shank of the steel separators. In other words, the whole tensional strength of the separators is available to keep the bearing in absolute alignment.

The generous bearing surfaces and the carefully proportioned parts, which have been so adjusted that the metal is never strained as in other bearings up to and beyond its breaking strength, are features that have combined to give to this bearing the extremely low coefficient of friction of 0.00127, as shown in laboratory tests, and a practically negligible amount of wear.

The development of this bearing was carried out in the automobile field, and the success achieved has led to its application to general carriage, wagon and truck work, and to that most severe of tests, the trolley and railroad service. The bearing has stood up so well under heavy trucking that steps are now being taken to enter that most severe field of trolley and railroad service.

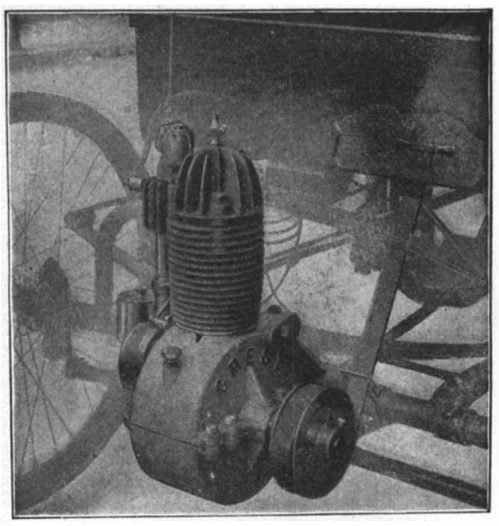
This is the third year of the bearing in active service and the results seem to be proving the claims of the bearing. It is found that the bearings need attention about once in three to six months according to the service. The saving in care is therefore an important element.

An interesting test was made recently with two heavy caravans of a Boston transportation company, one fitted with American roller bearings and one with plain bearings. The roller bearing van had been in service for ten months, and both vans were of the same type. They were loaded equally and a series of drawbar pull tests made on various kinds of roadbeds. An average of all the readings on both vans showed a net saving of 26.5 per cent for the roller bearing van. These bearings had received attention but once during the ten months and showed no perceptible wear.

Dr. Theodore W. Richards, who was recently called to the Chair of Chemistry at Göttingen, has been elected Professor of Physics at Harvard University.

AUTOMOBILE NOVELTIES.

The Crest Motor Starter.—A very handy device for starting the motor from the seat of the carriage is shown in the annexed cut as applied to the light runabout of the Crest Manufacturing Company. The apparatus consists of a drum on which is wound a belt that passes up through the floor of the vehicle and ends in a suitable handle. Fastened to the inside of the drum is a ratchet that some pawls on a plate keyed to the shaft of the motor, engage. A pull on the strap, therefore, turns the motor, after which a spring in the drum revolves it backward and re-winds the strap.

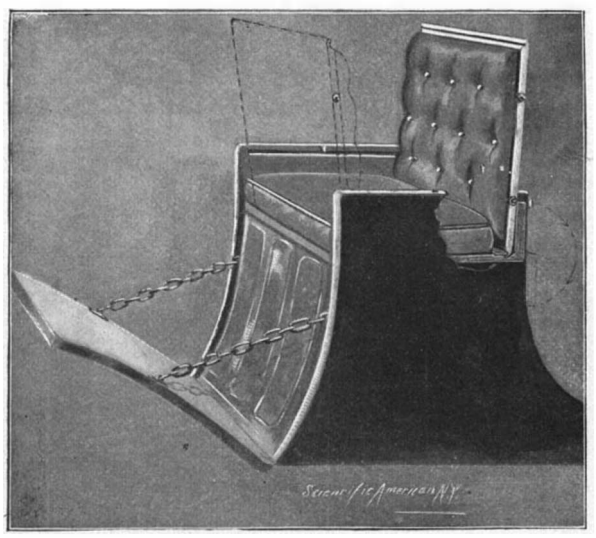


CREST MOTOR STARTER.

As soon as the motor starts, the pawls are thrown out of engagement with the ratchet by centrifugal force, and so produce no clicking noise.

The motor on the Crestmobile also carries a novelty in the shape of an exhaust valve lifter, by which the valve can be raised when the carriage is coasting, and the motor allowed to aspire cool air instead of an explosive mixture. This is one of the patented features of the Crest air-cooled motor.

Mr. Elihu Thomson, who is one of our best-known inventors, is the assignee of a patent recently granted to Otto F. Persson, of Lynn, Mass., for a novel reversible automobile seat. The back of the seat is provided with a double set of projections which work in closed-end slots formed in the back-supporting pieces. An opening is located between the ends of each slot in order that the seat may be inserted and removed. It is evident from this construction that the seat can be easily placed in the slots, shifted either forward or backward, and thus readily reversed. The ends of the



A NEW REVERSIBLE AUTOMOBILE SEAT.

slots are somewhat enlarged, so that the lower edge of the seat may fit into a notch in the seat in order to provide a rigid support.

The Hendricks Magneto.—Instead of a miniature dynamo, the Hendricks Novelty Company make a magneto with permanent magnets, for gas engine ignition. The claims of this company for a patent on a speed governing pulley that is applicable to any small dynamo or magneto have, we are informed, just been allowed, and the company intends putting the device on the market in the near future.

The Covert Running Gear and Transmission.—To anyone contemplating building his own automobile, the light runabout furnished by Byron V. Covert & Co. offers many advantages. The running gear is sold complete, with two clutches operated by a single lever all on, and the body attached also, if desired. All that is necessary to complete the rig is a suitable light motor. The company are now getting out a very neat complete vehicle of this type, which, ready to run, weighs only 400 pounds.

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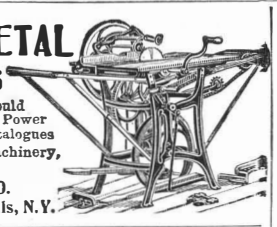

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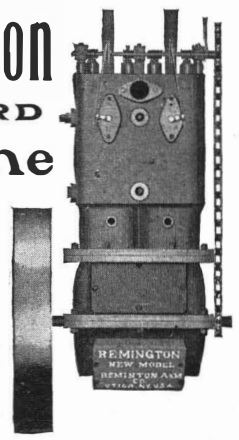

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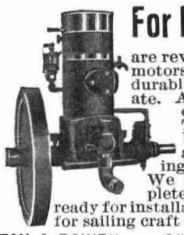

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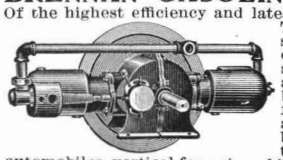

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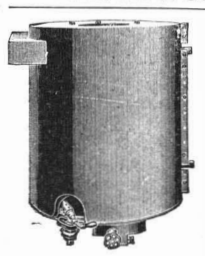

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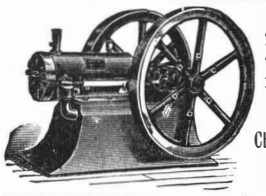

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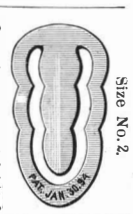

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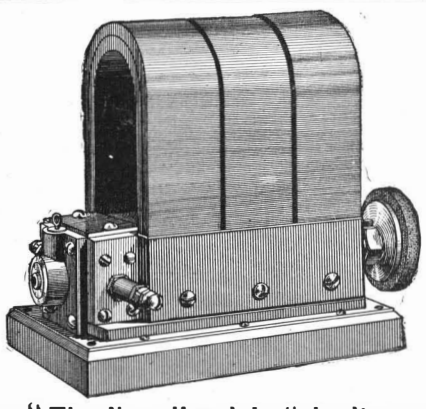

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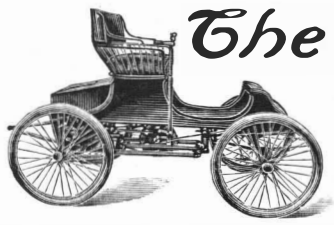

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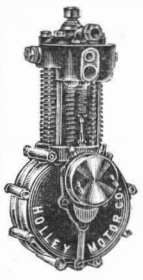

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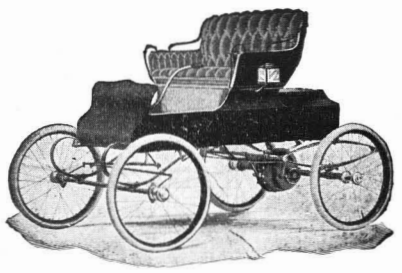

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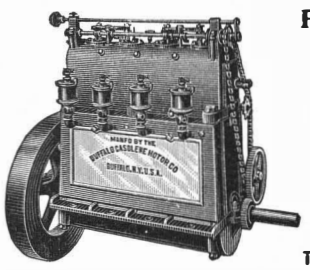

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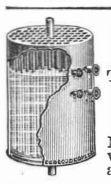

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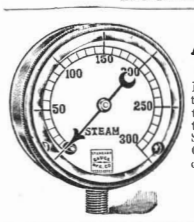

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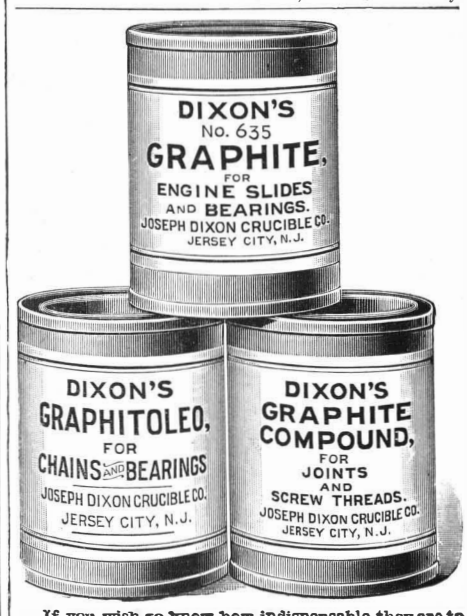

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Science Notes.

The construction cost of the Pan-American Exposition of Buffalo was $9,000,000; of the Paris Exposition of 1900 is said to have been $10,000,000; of the World's Fair at Chicago $18,000,000, while St. Louis will spend $30,000,000 in building her Louisiana Purchase Exposition in 1903.

K. Dieterich has applied for the patent for an extremely sensitive test-paper, which will indicate the presence of minute traces of alkali, as little as 1:1,000,000 of ammonia being detected by its means. An alcoholic solution of shellac and fluorescein is painted on a neutral black background. In the presence of the least trace of alkali this shows the characteristic green fluorescence. It is specially intended for the use of bacteriologists and for food analysts, since its extreme delicacy and relatively high price render it unsuitable for general use.—Pharm. Centralh.

The precocious son of Prof. T. D. A. Cockerell died recently from diphtheria. Though only eight years old he had made a number of quite remarkable discoveries of his own, says Science. He discovered the larva of *Picris occidentalis*, and raised the butterfly. He also found the first psocid recorded from New Mexico, and collected at least three new insects; a new bee of the genus *Epeolus*, described by Prof. Cockerell; a new meloid beetle, now in the National Museum, not yet described; and a new grasshopper of the genus *Melanoplus*, described by Mr. Scudder, and about to be published.

The influence of pressure up to 500 atmospheres on the viscosity of water at temperatures ranging from 15 deg. to 100 deg. has been studied by M. L. Hauser. The capillary tube method was employed, and the chief results were as follows: (1) Up to 32 deg. increase of pressure diminishes the viscosity. (2) In this temperature region the effect of pressure diminishes with increasing temperature. (3) In the neighborhood of 32 deg. increase of pressure up to 400 atmospheres has no effect on the viscosity coefficient. (4) Above 32 deg. the viscosity is increased by an increase of pressure of 400 atmospheres.

L. Portes and A. Desmoulières find that salicylic acid is a normal constituent of strawberries and natural strawberry juice, in which it is probably present as methyl salicylate. It occurs both in wild and cultivated fruits. They controvert the statement of Truchon and Martin Claude that the coloration obtained with ferric chloride in an ethereal extract of strawberry juice is due to a tannin, and demonstrate that the method of removing this advocated by those authors, also removes the salicylic acid. They have further succeeded in isolating the acid in a crystalline condition, and confirm its identity by other reactions. — Journ. Pharm. Chim.

Mr. Edward Dodson, an English explorer, has recently returned from a prolonged sojourn in the great desert of Tripoli, Northern Africa. This portion of the country has never been thoroughly explored, and indeed has not been visited by a European for over fifty years, so that Mr. Dodson's results are of inestimable value. One of the greatest achievements of the expedition was the exploration of the great petrified forest at Murzuk. Throughout this whole area which extended for several miles petrified trees were found, varying in circumference from seven feet to a few inches. Every branch of this forest was of course lying prone, and this together with the presence of marine shells showed that this part of the Great Sahara had at one time been submerged. On one occasion the party passed through a strange experience. They were surrounded by thunderstorms. No less than five distinct storms were in progress all round, and the guns and spears of the party became surrounded by a halo of phosphorescent light.

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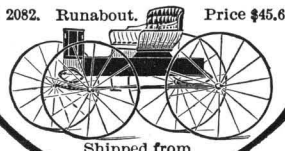

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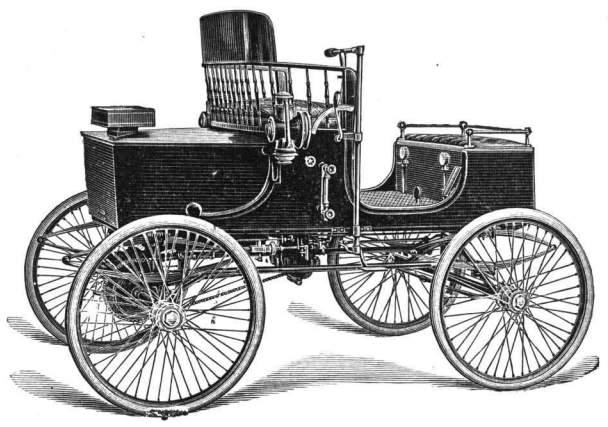
We will give you the wholesale price on any buggy, surrey, phaeton, or other high grade vehicle that we make at our factory. This price will be actual factory cost with a small profit added. You can buy from us on the same terms that the jobbers buy from the carriage factories. By our system of selling direct two profits are saved, and

YOU Get the Benefit

Satisfaction is guaranteed—if you are not satisfied with your purchase, return the carriage to us and we will pay freight charges both ways. We have also in stock a full assortment of harness and other horse equipments. Write for full illustrated catalogue.

The Columbus Carriage & Harness Co.

St. Louis, Mo. P. O. Box 54. } Write to nearest office. { Columbus, O. P.O.Box 772.



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W. H. Beach, Editor.

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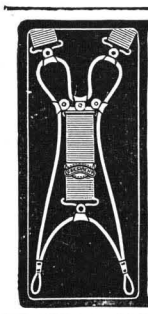

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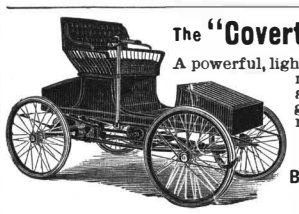

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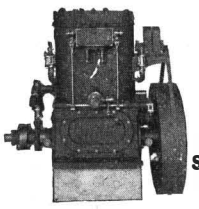

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GET THE BEST

Seven models to choose from

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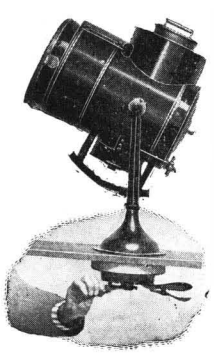

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53 MAIDEN LANE, NEW YORK

Engineering Notes.

An elevated railroad will be built on Market Street, running from the Pennsylvania Railroad station at Fifteenth Street, Philadelphia, westward to Sixty-third Street. It is probable that a subway will be built from Broad Street to the Delaware River, owing to the congested traffic on Market Street.

In Roumania, out of 454 locomotives on the standard gage roads, at the beginning of 1900, 175 had been fitted for burning petroleum residuum, says The Engineer. During 1900 twenty-eight more engines were changed to oil burners. Most of these engines, however, are so constructed that coal or wood, as well as oil, can be burned in them.

The total production of crude petroleum in the United States in 1900 was 63,362,704 barrels, being the largest for any year in our history. It was 6,291,854 barrels larger than that of 1899, the increase amounting to a little over 11 per cent as compared with 3 per cent gain in 1899 over that of 1898. It was greater by 2,402,343 barrels than the previous largest production, that of 1896.

The French Chamber of Deputies adopted, on June 28, the Waterways Bill, which comprises improvements in the existing canals at a cost of $12,100,000. The construction of the new canals includes one connecting the northern coal fields with Lorraine and another from the Loire to the Rhone, and a third from Marseilles to the Rhone, at a cost of $88,600,000, and improvements of the ports of Dunkerque, Havre, Nantes, Bordeaux, St. Nazaire and several other places at a cost of $31,800,000.

The first installation in Europe of the Talbot invention for the rapid manufacture of steel has been made at the Frodlingham Iron and Steel Company, Lincolnshire, England. This is the first attempt to reduce this process to actual practical use upon a large scale in the world, since there is only a small experimental furnace in this country. The inventor is a Salopian, but has resided in this country for some years. The furnace is tapped every four hours, and this constitutes a very rapid rate of manufacturing steel.

The firm of Krupp is preparing for a great display of ordnance at the Westphalian Arts Exhibition which opens in Düsseldorf in May next. This is the first thing of this kind done by the Krupps since the Columbian Exposition at Chicago and will be equally as elaborate. This coming display will cost over one million dollars. The exhibit will include types of the largest guns made by the firm, and at one end of the Krupp pavilion there will be shown the full-sized prow of one of the most recent designs in battleships, bristling with guns.

The commercial depression in Germany is developing into an acute question, especially in the iron and machine industries. In Chemnitz there are only three factories working. Orders for locomotives are scanty, and 20,000 workmen are working short time. At Aix out of 6,500 workmen 1,000 are on short time. The Nuremberg Electrical Company have introduced an eight-hour day owing to lack of work. The Breslau metal workers are practically idle, only 3,000 out of 13,000 being at work. In Magdeburg 300 men have been dismissed weekly. Canstadt tells a similar story. In Hamburg 1,200 men are idle and the wages of those at work have in many cases decreased 50 per cent. Employment is precarious. Frequently the weekly earnings amount to only $1.25. Few, if any, trades have escaped the depression. Furniture firms are everywhere reducing labor, especially in Hamburg. Konigsberg, Chemnitz, and Brunswick. Even banks are discharging their employés. The outlook is so serious that active steps are being taken by the governments of Prussia, Bavaria, Hesse, and Baden to meet the distress.

Electrical Notes.

An American company has secured concessions for the operation of many European canals by electricity. Altogether 5,000 miles of canals are controlled in England and on the Continent.

The Transalpine telephone line, connecting the systems of France and Italy, was inaugurated January 1. Signor Galimberti, Italian Minister of Posts and Telegraphs, exchanging greetings from Turin with President Loubet in the Palace of the Elysée with entire success. The line was subsequently opened to the public. It does not extend beyond northern Italy. The connection with Rome has not been completed.

A record feat in armature winding is claimed to have been accomplished by the Niagara Falls Power Company recently, which re-wound a 5,000 horse power armature at the Falls power house in five days. In order to perform this work in the required time, a double shift of ten men was kept working day and night. An interesting feature of the work was the use of a small electric motor to blow the blacksmiths' forge, on which charcoal was burned.

Three furnaces of 500 electric horse power are said to have been erected in the valley of Camonica, Northern Italy, for the manufacture of pig iron under the Stassano patent. The furnaces in general outlines resemble cupola furnaces using coke, their special features being apparent in the provision made for supplying electric current and in the electrodes placed at the bottom of the boshes. To obtain a ton—metric—of metal, 3,000 horse power hours are required, which costs about 18 francs.

Consul Thackara reports from Havre, December 5, 1901, that the Commercial Cable Company, of New York, has laid a new submarine cable between Horta, Island of Fayal, Azores, and Waterville, Ireland. The shore connections at the latter place were successfully made on November 30. This cable, says the consul, is an extension of that laid by the same company in 1900, and increases to four the number of cables operated by the Commercial Company between Canso and Waterville. As Havre is connected by a submarine cable with Waterville, the direct-telegraph service with New York will be benefited by the new cable.

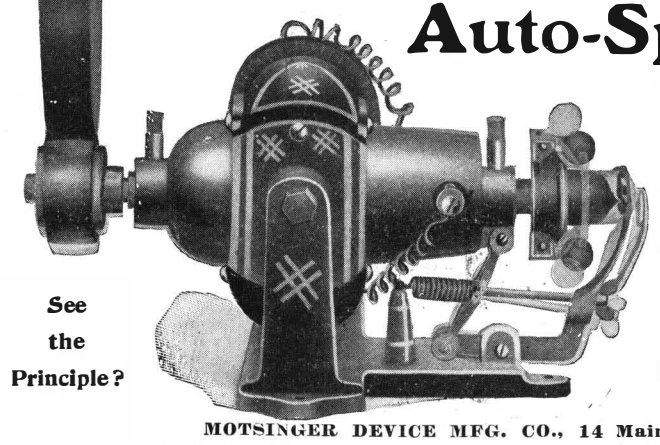
An important invention by Herr Rudolf Bartelmus, an electrician of Vienna, for the prevention of railway accidents, has been subjected to severe experiments by the Austrian Railway Officials' Club. The locomotive for the purpose was worked automatically by means of a contact rail along the entire distance, combined with a dynamo and a steam turbine. In case of any obstruction being encountered on the line, the newly invented device works as a progressive check. That is to say, it gives notice first at a distance of 2,400 yards, then at 1,200 yards, and finally, if the previous signals remain unheeded, at 600 yards from the obstruction the steam is automatically shut off on the engine, and the brakes work, so that the train comes to a standstill.

The Post Office Department has authorized the experimental establishment in Toledo, O., of an electrical appliance to record collections from street and office mail boxes, says The Railway Review. The object of the proposed system is to prevent collectors of mail from skipping boxes. The device is so constructed that whenever a box is opened a record of the opening is signaled to the post office. Where there are a great many boxes, in cities of a population of 100,000 and over, it is thought the system would prove valuable. It would also be a valuable addition in sparsely settled communities, where boxes are a long distance apart. Here, it is reported, collectors frequently skip boxes. This violation of regulations could be entirely prevented if the electric appliance was attached to each box.

To Owners of Gas Engines, Automobiles and Motor Carriages.

You can avoid use of batteries and expense of their constant renewals if you have in their place an

Auto-Sparker.



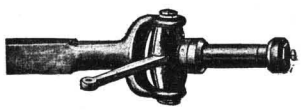
See the Principle?

It can be attached to any engine, new or old. An Automatic Dynamo which has been in general use on motor carriages, etc., for more than two years, with the universal verdict by all users that it is practical and a *Pronounced Success.*

"You can't fool all the people all the time." Many people have been fooled and disappointed in buying cheap Magnetos and cheap *Motsinger Imitations* but the recent and large increase in our sales indicates that many admit that they were fooled.

Write us for Users' Testimonials and Booklet O.

MOTSINGER DEVICE MFG. CO., 14 Main Street, Pendleton, Ind.



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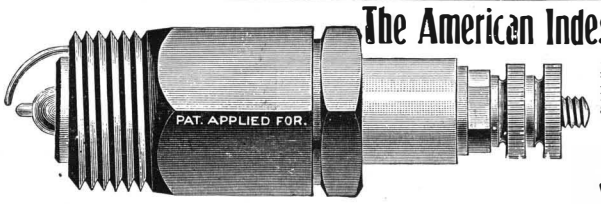
Wheels and Rims any diameter for any section tire. For vehicles from 300 to 2,500 lbs. 17 years experience back of every wheel. Made by specialists in a special factory. Give us the weight of your vehicle and size tires for specifications and prices.

WESTON-MOTT COMPANY, UTICA, N. Y.

The American Indestructible Sparking Plug



For Gas Engines, is the only absolutely reliable sparking plug on the market. We lead the world on ignition apparatus. Write for catalogue.

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RIMS that are RIGHT

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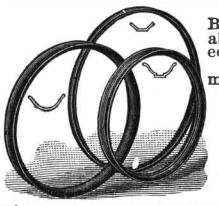

Seamless Drop Center, Flat Base and Plain Crescent Rims, all with or without flared edges.

In another department we make all sizes of

SEAMLESS STEEL TUBES, SEAMLESS STEEL BOILER SHELLS, SEAMLESS STEEL BOILER TUBES, and FLANGED BOILER HEADS.

If interested in Electric Welding write or have our representative call.

THE STANDARD WELDING CO., Cleveland, O.

SUBMERGED

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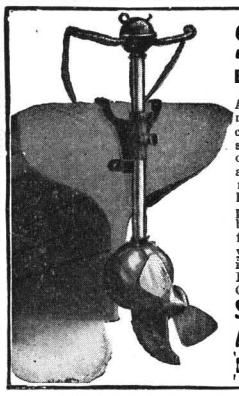

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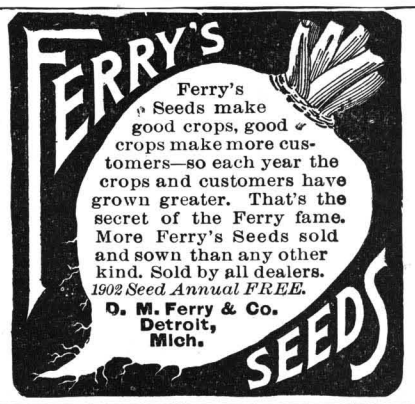

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Incandescent Gasoline Lamps

give most light for least money. They vaporize gasoline and burn the vapor mixed with air, using an incandescent mantle, and produce **100 to 600 candle power for each burner.** The light is steady and strong, and perfectly safe.

Average use costs 3c. per week. Handsome fixtures from $3.50 upward.

Everything in gasoline lamps for in-door and out-door use. We have "One match" and also alcohol lighting burners, in both overhead and under generators. Ask for catalogue N.

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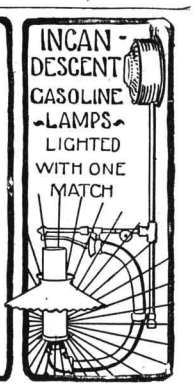

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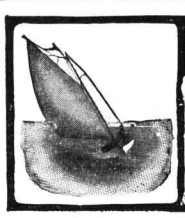

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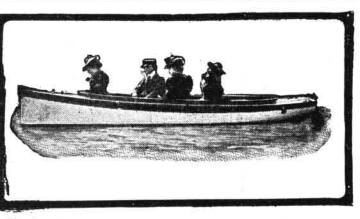

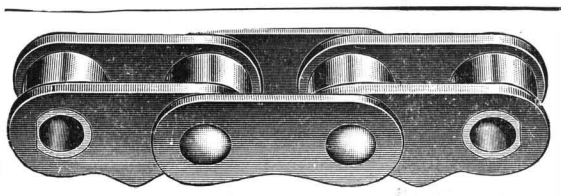

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THE WHITNEY MFG. CO., HARTFORD, CONN.

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THIS IS IT! Paine's Perfect PIPE

Patented April 20, 1897. **Simple, Durable, Economical, Clean.**

While lighted the inner bowl can be raised to **clean or remove obstructions without emptying** or wasting the tobacco. **No Nicotine can enter the stem,** as it is all deposited in the smoke chamber surrounding the tobacco bowl. **No center draft** to leave unburned tobacco around the sides. **Openings for smoke opposite the stem,** so that smoke passes around bowl before entering the stem, insuring **clean, sweet smoke. Pipe never burns out** because extra tobacco bowls may be had at a fraction of cost of pipe. **PRICES, prepaid by mail to U. S. and Canada: French Briar,** bent or straight stems, amberoid mouth piece, **50c.** each. **French Briar,** bent stems, pure rubber mouthpiece, **50c.** each. **French Briar, first quality,** bent or straight stems, amberoid mouthpiece, **75c.** each. **French Briar, first quality,** bent stem, pure rubber mouthpiece. **75c.** each. **Best quality. Selected French Briar,** bent or straight stems, real amber monthpiece, **$2.00** each. **Extra Bowls for 50c.** pipes **20c.** for all other pipes, **25c.** each. **EVERY PIPE WARRANTED.** Dealers, every pipe you sell will sell others. Write for price list. Address,

FRANKLIN R. PAINE, Sole Patentee and Manufacturer, **Duluth Minn., U. S. A.**

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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Marine Iron Works. Chicago. Catalogue free.

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Sheet metal stamping and light manufacturing. Forskeil Motor Co., Anderson, Ind.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

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Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

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For sheet metal stampings and novelties try Standard Stamping Co., Seventh and Hudson, Buffalo, N. Y.

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Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

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Are you looking for anything in bent woodwork? Write Tucker Bicycle Woodwork Co., Urbana, Ohio.

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Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

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Patents developed and manufactured, dies, special tools, metal stamping and screw machine work. Metal Novelty Works Co., 43-47 S. Canal St., Chicago.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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WANTED.—To interest responsible parties in the manufacture, on royalty basis or otherwise, of a recently patented tool of exceptional merit. Address M. D. Tillman, Wabash, Ind.

Inquiry No. 2122.—For manufacturers of kid glove fasteners.

To be successful, an automobile manufacturer should control and use a patented engine. I will sell patent or right to manufacture such an engine. Address H. B. Ogden, 204 Carroll St., Brooklyn, N. Y.

Inquiry No. 2123.—For manufacturers of crepe (mourning) flowers.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines. Correspondence Solicited. Address C. A. M. Box 773, New York.

Inquiry No. 2124.—For manufacturers of potters' wheels and supplies.

MANUFACTURER WANTED.—For patent shaft-governed high-speed engine, fully demonstrated, authentic tests. All machine works standarized for cheap production. Full working drawings and personal supervision if required. Address Y. K. E., at Horncastle's Advertising Offices, 61 Cheapside, London, England.

Inquiry No. 2125.—For makers of the metal parts of shade rollers.

WANTED.—Reliable, sober and competent foreman for machine shop department. Thorough mechanic, one who understands up-to-date methods of producing work economically and handling men. State experience, give references and salary. Great Western Mfg. Co., Leavenworth, Kansas.

Inquiry No. 2126.—For outfits for the manufacture of window and door screens.

Motor Vehicles. Duryea Power Co., Reading, Pa.

Inquiry No. 2127.—For the present address of the Columbian Time Recorder Co., formerly of New York.

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Valve balancing device, R. L. Ambrose 693,484
Valve, fluid pressure signal, H. R. Mason 693,415
Valve, steam boiler safety, C. Gulland 693,513
Vehicle brake, De Berly & Rassinier 693,776
Vehicle brake mechanism, G. F. Moore 693,731
Vehicle driving mechanism, P. Synnestvedt 693,574
Vehicle seat, folding, C. F. Kimball 693,654
Vehicle splinter bar, A. Kuszmink 693,405
Vehicle wheel, C. Degrange 693,380
Vending machines, etc., receptacle or casing for, H. H. Pulver 693,532
Violins, etc., bridge for, A. Hurley 693,648
Vise, bench, C. I. Yonge 693,811
Wagon seat, W. J. Holland 693,392
Waist, skirt, and belt holder, L. A. Emery 693,383
Washboard, M. E. Bingaman 693,364
Water cooling and condensing tower, H. B. Schmidt 693,625
Water cooling apparatus, C. A. Falk 693,506
Wave motor, W. S. Bryant 693,369
Weed cutting and ballast dressing apparatus, V. Berford 693,363
Weeder, A. Johnson 693,717
Weighing machine, liquid, W. W. George 693,794
Wick tube, W. H. Wilder 693,476
Wind wheel, O. J. Ziegler 693,481
Wire rope machine, E. P. Frederick 693,509
Work support, J. T. Summers 693,673

DESIGNS.

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Belt, H. C. Krause 35,767
Belt body or similar article, I. Lewenthal 35,766
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Butcher's tool, W. H. Moffitt 35,758
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Gem setting finger ring, solitaire, C. T. Wittstein ..... 35,742, to 35,745
Gem setting, solitaire, A. H. Wittstein 35,741
Hammock fabric, I. E. Palmer 35,753
Hose supporter, F. A. Freeman 35,752
Manicure blade, A. N. Clark 35,746
Purse top or similar article, S. A. Keller 35,747
Puzzle board, T. C. Washington 35,764
Reflector for artificial lights, O. A. Mygatt. 35,755 to 35,757
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Surgical rubber pad, W. P. Richards 35,749
Vehicle body, W. S. Rogers 35,763
Vessel, B. P. Wagner 35,759
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Books, certain named, C. L. Dressler & Co 37,803
Carpet sweepers, Bissell Carpet Sweeping Co. 37,823, 37,824
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Chocolate and confectionery, coatings for, H. H. Ottens 37,807
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Cutlery and hardware and surgical instruments, certain named, M. Klass 37,829, 37,830
Feed, gluten, National Starch Co 37,813
Filters, portable and stationary, Celler Filter Werke, Gesellschaft mit Beschrankter Haftung 37,826
Fish, preserved, Seacoast Packing Co 37,808
Flour, wheat, Listman Mill Co 37,809, 37,810
Food, cereal, C. G. Vary 37,811
Fuel, artificial, Randall Synthetical Coal Co 37,822
Game boards, W. Fuld 37,805
Game, parlor, W. Fuld 37,806
Lures, artificial, G. H. Burtis 37,821
Meal, including gluten meal, National Starch Co 37,814
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Pills, resolvent, Potter Drug & Chemical Corporation 37,820
Remedy for a certain named disease, H. Mayes 37,819
Remedy for diseases of the mouth and throat, Ozo Remedy Co 37,818
Roundabouts, hydraulic, Aquarama Co. 37,831, 37,832
Sanitary appliances, certain named, Sumner & Goodwin Co 37,827
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Tea, coffee, cocoa, and chocolate, Mazawattee Tea Co 37,815
Tires, vehicle, New York Belting & Packing Co 37,834
Toys and display trays or carrier for toys, R. W. Beiser 37,804
Trousers, L. D. Levy 37,802
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Whisky, E. J. Quinn 37,817

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"Busy Bee," for cigars, E. de Bauernfeind and C. Blesse 8,976
"Caloric Punsch," for punch, B. Lindqvist & Co. 8,978
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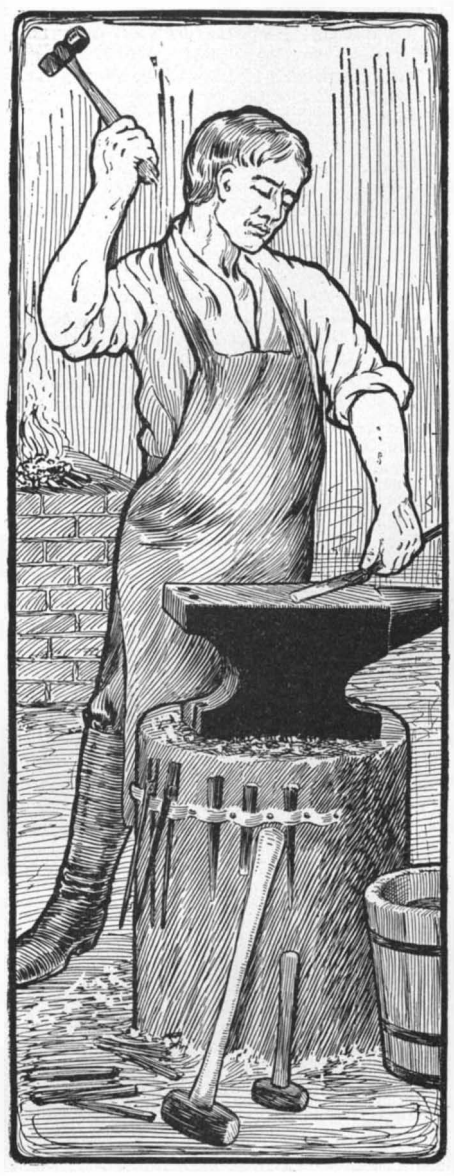
"Dys-Pep-Cide," for a medical compound, C. D. Voorhees 8,972
"Knight's Consumption, Bronchitis, Asthma Cure," for medicine, A. Knight 8,971
"Malt-Too," for a food preparation, Malt-Too Flake Food Co. 8,974
"Perfumol," for breath perfume, Perfumol Co. 8,975

PRINTS.

"Clothing," for clothing, W. C. Both 468
"Priscilla," for skirt fasteners, Goodspeed Mfg. Co. 469

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.



THE OLD WAY

SINCE the days of Tubal Cain, up to a few years ago, it was necessary to produce the strongest parts of metal work by hammering. In the olden days the heated metal was laid on one flat stone and hammered with another, or with a primitive sledge. The flat stone developed by slow stages into a block of metal, at first square and unhandy, but as time passed and men developed ingenuity, the block grew a nose and became an anvil, by means of which the blacksmiths of old shaped curved articles. They fashioned horse shoes, linked chain armor and welded blades. From the old time armorer, the blacksmiths, and other workers of metal, whose sturdy blows rang music from the anvil, is descended the ponderous trip-hammer—ponderous, yet so delicately adjusted that a blow can be struck as light as air, and one so mighty that a block of granite is crushed to powder. Invention has succeeded invention until the rude flat stone has developed into a die carefully and laboriously cut and shaped by hand, into which the glowing metal is forced, not by the sinewy arm of a modern Tubal Cain, but by the power of steam, through tendons of steel or by the hydraulic pressure of water squeezing the metal into shape. All are modifications of the old brawny arm and skillful hammering method. Slow, expensive, and subject to ruinous misplaced blows and defective machinery, it is a process that is still retained only because none better had been discovered. Even with the most modern machinery, with the aid of wonderful trip-hammers, of powerful hydraulic presses that mould metal as a sculptor models clay, the process is costly and slow, the machines, enormous or delicate, must be adjusted, whether one or fifty pieces are to be produced. The die must be cut with the finest skill by hand out of steel as hard as flint. And after all this the article must often be tempered, annealed or planed before it is ready for use. Such is the old process of steel production—the process of Tubal Cain, grandson of Methuselah, and his descendants.

AND THE NEW

The new steel process is a short cut to the result wanted. From the enormous melting furnace to the finished article is but one step by the Jupiter Steel process. Scarcely five years ago two metallurgists discovered a method by which scrap steel (discarded machinery, old boiler plates, broken crank shafts and the like), melted and mixed with certain ingredients and poured into a simple mould of special sand, produced steel equal, in strength and temper, to forgings vastly more expensive. By this means old scrap steel of little value is transformed into tools capable of holding the finest edge, or into immense castings of the greatest strength and toughest fibre. Like all great and successful inventions its simplicity makes it profitable. All the time-wasting, expensive processes of forging, tempering and annealing are avoided. Carefully measured ingredients are introduced into the boiling mass of steel scrap and the finished cast will have all the qualities of the best tool steel or the forged and turned engine crank, as you wish. The secret lies in the mixture which the modern alchemists, Messrs. Whall and Lundin, have discovered, and the United States Steel Company own the patents thereon both in this and twenty-three foreign countries.

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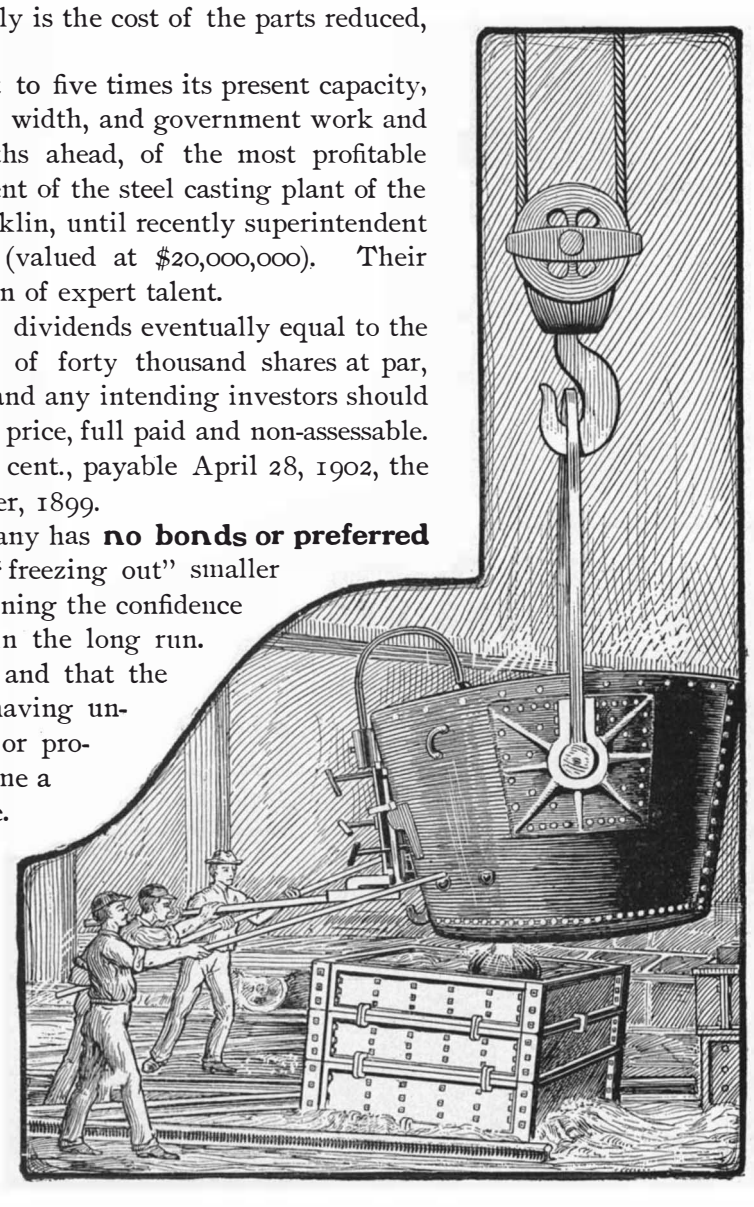
The foreign patents, now being negotiated, show conclusively a source of dividends eventually equal to the entire capitalization of the Company. Of their recent offering, in December, 1901, of forty thousand shares at par, **$5.00 Per Share,** over twenty-three thousand shares have been subscribed for and any intending investors should take prompt action if they desire to take any more of the remaining stock at the same price, full paid and non-assessable. All accepted subscriptions will draw the full regular quarterly dividend of 3 per cent., payable April 28, 1902, the Company having paid regular **12 per cent. per annum** dividends since December, 1899.

We desire to call the attention of those interested to the fact that this Company has **no bonds or preferred stock,** and that there is, therefore, no opportunity for any interests combining and "freezing out" smaller stockholders. The Company has always been conducted from the standpoint of obtaining the confidence of stockholders, large and small, for that policy will certainly bear best fruits in the long run. Also that there are in the treasury two hundred and ten thousand shares of stock, and that the Company owns seventy-four acres of good manufacturing land, finely located and having unexcelled railroad and water facilities. The Company's officers are not stock brokers or promoters,—just plain business men engaged in establishing what is destined to become a large and profitable New England industry, in which they invite you to participate. Upon request they will be pleased to send a full prospectus of the Company, together with photographs and a record of what has been accomplished in the past two years, and such information as an investor may desire, and bank reference, if required. Preference will be given to subscriptions in the order of their receipt.



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(Continued from page 155.)

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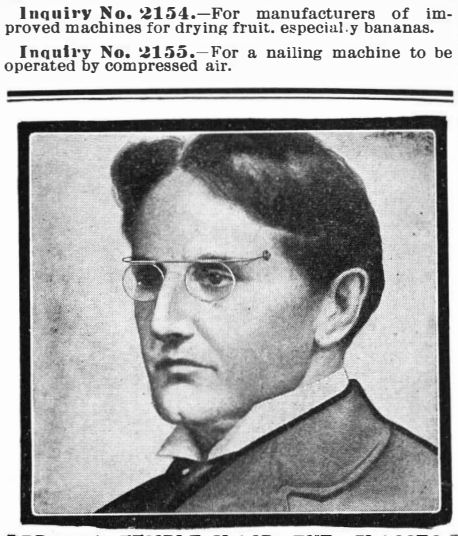

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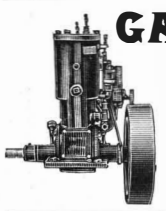

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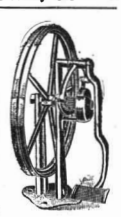

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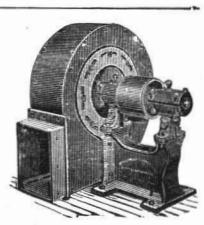

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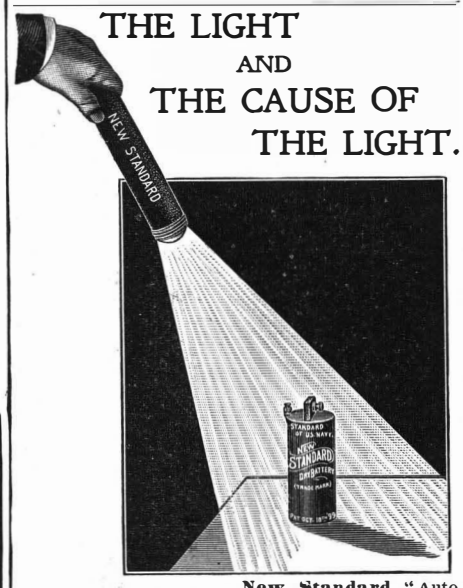

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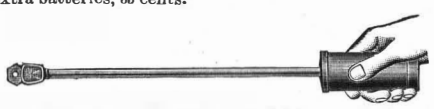

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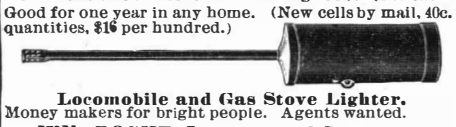

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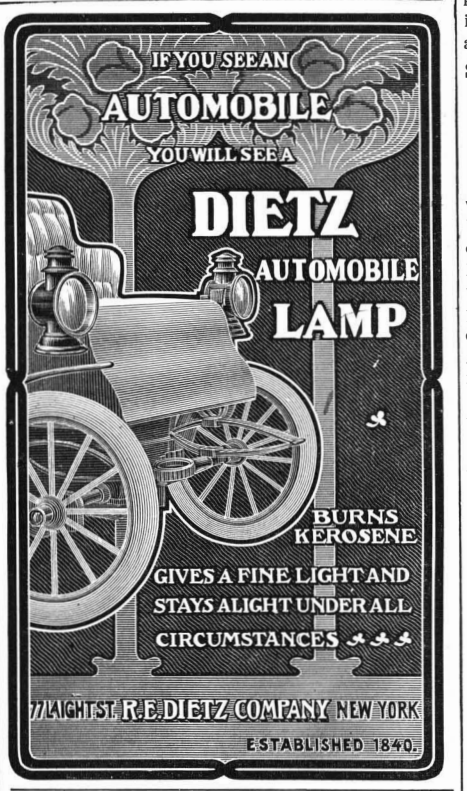

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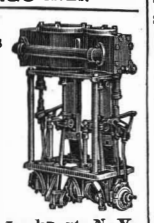

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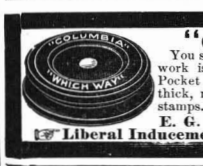

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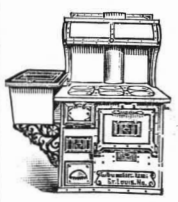

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Poor's Manual is a standard handbook and official organ of the railroad systems of the country, and of every interest connected therewith, containing detailed statements of operations and conditions of every railroad company in the United States and Canada, and the leading railroads in Mexico. Every statement is officially revised before publication. The most important feature introduced into the Manual in recent years is one presented in the edition for 1900, and is entitled "Ready Reference Bond List." Poor's Manual is by far the best publication of its kind and its reliability and thoroughness make it absolutely indispensable to every railroad and financial man.

Studies in Heterogenesis. By H. Charlton Bastian, M.A., M.D., F.R.S. First Part. London: Williams & Norgate. 1901. 8vo. Pp. 61. Plates. Price $3.

The author is a well-known medical man who has written a number of books upon the brain and paralysis. He uses the term heterogenesis in the sense originally employed by Burdach, as a class name for processes by which living things arise from the matter of pre-existing organisms belonging to a totally different species—the correlative term homogenesis being used by them as at present, for the process by which individuals arise in the ordinary way from pre-existing living things similar to themselves in organism. Briefly, however, he defines the term heterogenesis as the production from the substance of organisms or their germs of alien forms of life. The author deals with one of the most difficult subjects in the scientific world and the net result of his contribution to the literature of science is sure to be appreciated.

Centrifugal Pumps, Turbines and Water Motors. Including the Theory and Practice of Hydraulics. By Charles H. Innes, M.A. Manchester: Technical Publishing Company, Ltd. 1901. 12mo. Pp. 226. Price $1.80.

The author has put in as concise form as possible the theory of turbines, centrifugal pumps and fans. In one of the chapters will be found a description of steam turbines, for which he is indebted to the Hon. C. A. Parsons, and it is one of the most important discussions of the subject which we have ever seen. In the preparation of the book no effort has been spared to make the text as clear as possible, and the illustrations are numerous.

How to Remember Without Memory Systems or With Them. By Eustace H. Miles, M.A. London: Frederick Warne & Co. 1901. 12mo. Pp. 278. Price $1.

This book is practical rather than technical. It does not contain long discussions as to what our memory is or what it is not, but gives in concise form pieces of advice as to how we may best remember. The principles are based on methods which most of us do already frequently use with excellent results. Each person is left free to choose his or her own way, system or systems, but it should be tried fairly before condemning. Yet, lest any should say that it is a waste of time to learn systems at all, the author has tried to show the value of a good memory, and the good effects of ways and systems if properly used on the character, and on success in various branches of life.

Commercial Trusts. Growth and Rights of Aggregated Capital. By John R. Dos Passos. New York: G. P. Putnam Sons. 1901. 12mo. Pp. 137.

The present work is an argument delivered before the Industrial Commission at Washington, D. C., December 12, 1899, corrected and revised. The author deals with aggregations of capital, commercial corporations, over-capitalization, regulation of capital, legal control, anti-trust laws, regulation of trusts, legislation and other allied subjects.

Subject List of Works on Certain Chemical Industries in the Library of the (British) Patent Office. London: The Patent Office. 1901. 16mo. Pp. 100. Price 20 cents.

We have commented favorably upon the excellent series of publications which the British Patent Office is issuing from time to time. They are highly useful, and the present volume is one of the best of the series. It includes destructive distillation, mineral oils and waxes, gas lighting, acetylene, oils, fats, soaps, candles, perfumery, paints, varnishes, colors, resins, paper and leather industries.

Electromagnets for Design and Construction. By A. N. Mansfield, S.B. New York: D. Van Nostrand Company. 1901. 16mo. Pp. 155. Price 50 cents.

An excellent little book of pocket size in the Van Nostrand Science Series, of which 112 volumes have now appeared. The author treats the subject mathematically, and the formulas and data which are essential to the design and construction of electro-magnets for various purposes are here presented in convenient form.

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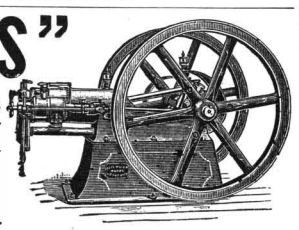

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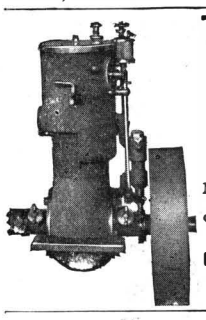

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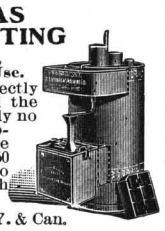

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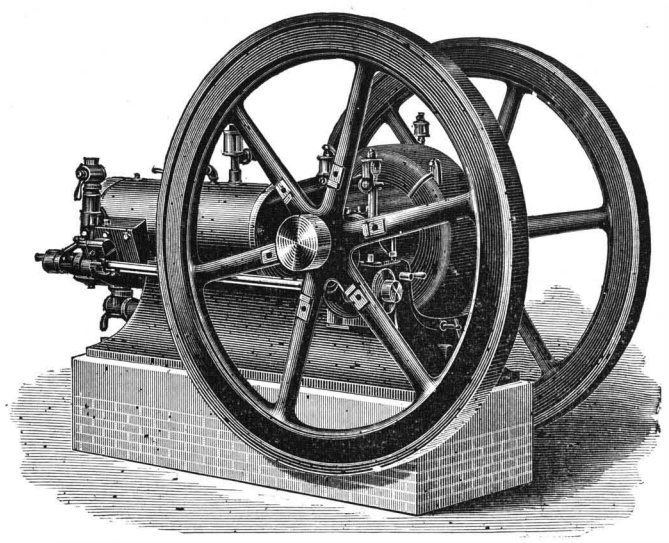

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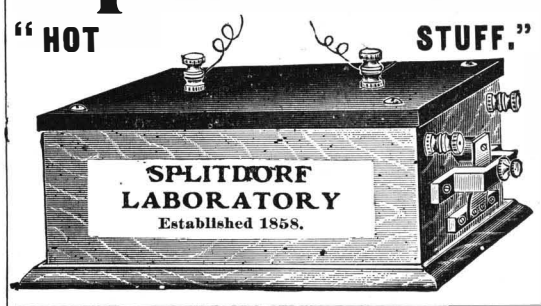

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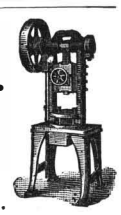

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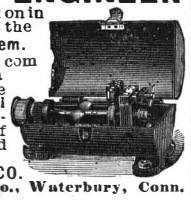

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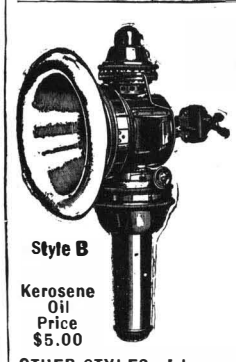

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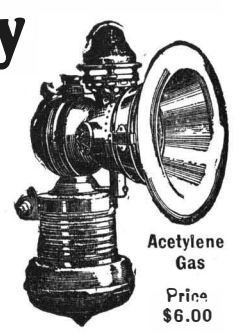

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8534) H. D. F. writes: I have a coil which will give a six-inch spark, and have masts erected on the roofs of the buildings, about 1,000 feet apart. Using the coils with the arrangement described by Mr. A. F. Collins in the SCIENTIFIC AMERICAN of September 14, 1901, will I be able to obtain good results? A. Yes.

(8535) S. B. S. asks: 1. Will a 4-ohm telegraph work on a line one mile in length? A. Yes, if all else is in good shape. 2. If so, how many gravity batteries will be required to work the instruments if No. 12 galvanized iron wire is used with ground circuit? A. The number depends upon the joints and insulation. We should put 4 to 6 cells and try it. Then add others if necessary. 3. How many gravity batteries will be required to work two 4-ohm telegraphs on a line 265 feet in length, where No. 18 uninsulated wire is used with ground circuit? A. Probably two will do the work.

(8536) D. H. asks: 1. Is there any way that a number of open-circuit sal-ammoniac cells (say twelve) can be connected together so as to produce a continuous current for an incandescent light? Is there any apparatus made for such cells to make them produce a more continuous current? A. No. It is impossible to use a sal-ammoniac cell on a closed circuit for any length of time. 2. Will dry cells recuperate as quickly and as well as wet open-circuit cells? A. No.

(8537) M. B. T. asks if putting the antennæ of a wireless telegraph system in an iron or other pipe will prevent the emission of the Hertzian waves? A. Anything which disturbs the free outflow of the waves from the vertical wires will disturb the transmission.

(8538) E. H. S. asks: 1. I should like to know something about the mathematics of an induction coil; how to calculate its probable output and what vital points tend to increase or diminish its efficiency. A. You will find in our SUPPLEMENT No. 1124, price ten cents, the description of a coil which gives a 6-inch spark. This will do X-ray work upon the thinner portions of the human body. For the thickest parts, a coil is employed which will give a spark of 14 inches or more. Such a coil is described in Hare's "Large Induction Coils," price $2.50 by mail. 2. Something about the Wehnelt electrolytic interrupter. A. We can send you five numbers of the SUPPLEMENT containing illustrated articles upon the Wehnelt interrupter, at ten cents each. SUPPLEMENT, pages 19602, 19811, 20871, 20982, 21500. 3. How to build an induction coil suitable for X-ray work, etc.? A. Faraday's laws of the induced current cover the action of a coil. The correct designing of a coil is the result of experience extending over many years, as well as the application of law to the case.

(8539) W. E. A. writes: 1. I would like to know if there is any advantage in using plate rather than ordinary glass regardless of difference in price? The plate will run opposite-y 1-16 inch apart (20 inch D.), while some window-glass may run seldom less than 3-4 inch apart. A. It is an advantage to bring the plates of any static machine as near to each other as possible. If they will not run nearer than ¾ inch apart, the machine will not be very efficient. 2. The plate is usually about 3-16 inch thick. Does this thickness of glass take away from the efficiency of the machine? A. It is not advisable to use glass of a greater thickness than will stand the strain of the running. 3. Could you also tell me as to how I can obtain drawings or descriptions of the arrangement of conductors or carriers for a two-plate Wimshurst? A. A good design of a Wimshurst machine can be found in the Bottone's "Electrical Instrument Making," price 50 cents, by mail.

(8540) J. F. McG. asks: 1. What is the temperature of a 30-candle power incandescent electric light? A. The temperature of incandescence is not directly connected with the candle power of a lamp. Ganot gives the temperature as 2,350 deg. Foster's Pocketbook gives it at about 2,500 deg. 2. What is rare earth and where can it be obtained? A. Certain minerals have been known

(*Continued on page 160*)

among chemists as earths. The rarer ones are zirconia, glucinia, yttria and thoria. They are oxides of elements of similar names. 3. What candle power would a 220-volt lamp give? A. It may be of any candle power, depending upon the resistance of its filament.

(8541) R. B. asks: 1. Will a watch become magnetized by a motor? A. Yes; if there is much external magnetism in the space around the motor. 2. How can you tell if it is? A. By its irregular motion, or failure to keep time as well as it has been doing, often even stopping entirely. 3. How can it be demagnetized thoroughly? A. The quickest way is to take it to a jeweler, who is nowadays quite accustomed to this disease of watches. We can send you two valuable articles on the subject for 20 cents.

(8542) D. S. asks: Will you please answer through the columns of your valuable paper, if a small motor or dynamo, say 1-16 to ⅛ horse power, can be designed the same as larger machine of 1 horse power or over, that is in regard to the magnetic flux in the different parts? A. All dynamos are designed by the same rules.

(8543) F. M. C. asks: 1. In winding the primary and secondary coils for a medical battery (faradic current) should both be wound right or left hand, looking from the same end of the coil, or should one be wound right hand and the other left hand? A. We do not see how it can make any difference in which direction the turns of a coil are wound. The electrical induction will find that out for itself. 2. In using a galvanic battery, for medical purposes, of say ten carbon and ten zinc plates arranged zinc to carbon through the entire number, is it absolutely necessary to have each element, that is a carbon and zinc plate, in a separate cup or cell with the fluid, or will the battery work as well, and the current last as long, if *one* large cup is used containing *all* the elements and fluid? A. If all the plates are in one cell, you will have one cell with the electromotive force of one cell, but with the amperes due to the large surface of your single plate. The same state of the current results if you connect all the positive plates together, and all the negative plates together from a larger number of smaller sized cells. This is *connecting in multiple*. If, on the other hand, you join the zinc of one cell to the carbon of the next in series, you will have an electromotive force equal to that of one cell multiplied by the whole number of cells, and a less number of amperes because of the greater resistance of the arrangement. This is a battery *connected for intensity*.

(8544) W. H. G. asks: 1. Please give acid used in pole indicator and ground detector and state what size and kind of wire is used. A. Make a solution of alcohol, 10 cu. cm., phenolphthalein, 1 gramme. Add to this distilled water, 110 cu. cm. Make a second solution of sodium sulphate, 20 grammes, in 100 cu. cm. of water. Soak blotting paper in the first solution, and drain off the superfluous liquid. Then soak the paper in the second solution and dry the paper. To test the poles of an open circuit, moisten a strip of the paper, and place the ends of the wires about two inches apart upon it. A red spot will appear around the end of the negative wire. 2. Is there any way in which a bipolar dynamo can be made to give a steady current and not an alternating current? I cannot run a Ruhmkorff coil because of this, and would like to know if there is any instrument or battery that I can connect in circuit to stop this alternation? A. A dynamo gives a direct or continuous current when its armature is provided with a commutator. The same machine gives an alternating current when its armature is fitted with rings connected to the windings. Either form of dynamo will work a Ruhmkorff coil equally well. If the alternating current is to be used, screw down the break circuit so that it will not vibrate. 3. Do I understand that in the system of wireless telegraphy explained in Scientific American of January 4, 1902, there is no Ruhmkorff coil used in the transmitting part, but just the batteries connected to the earth? A. We have no facts additional to those in the article referred to. 4. What are inductance coils, and please give idea of how made? What is a choke coil, and how made? A. An inductance or a choking coil is a coil to reduce the current by its induction upon the current as it passes through it. A second current is set up in the inductance coil, which flows in the opposite direction to the main current and thus chokes it off, so to speak. 5. Please give number of Supplement, if you have same, that has plans and working drawings for constructing small gasoline motor. A. See Supplements Nos. 715 and 716, for construction of gas engines, 23 figures, 10 cents by mail. Also a book on "Gas Engine Construction" by Parsell and Weed, $2.50 by mail.

(8545) J. W. J. asks: What depth of water does it take to float the largest ocean steamers loaded, and also which are the three largest steamship companies? A. The largest ocean steamer is the "Oceanic." If she were loaded to her maximum capacity, she would draw 36½ feet of water. The Hamburg-American, the North German Lloyd and the White Star are the largest steamship companies.

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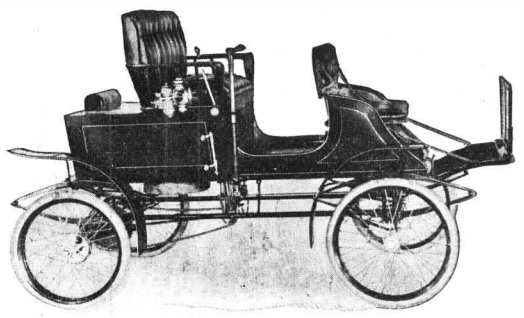

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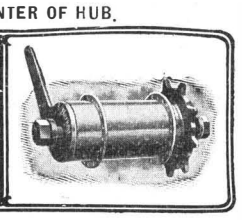

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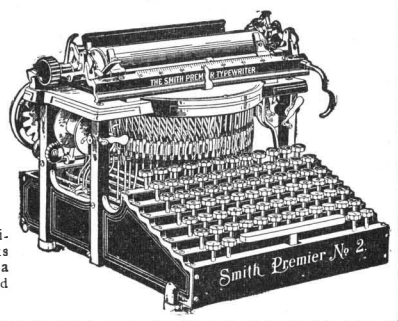

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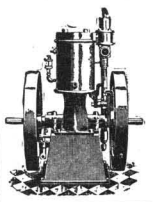

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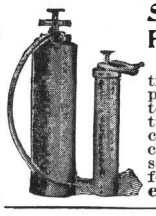

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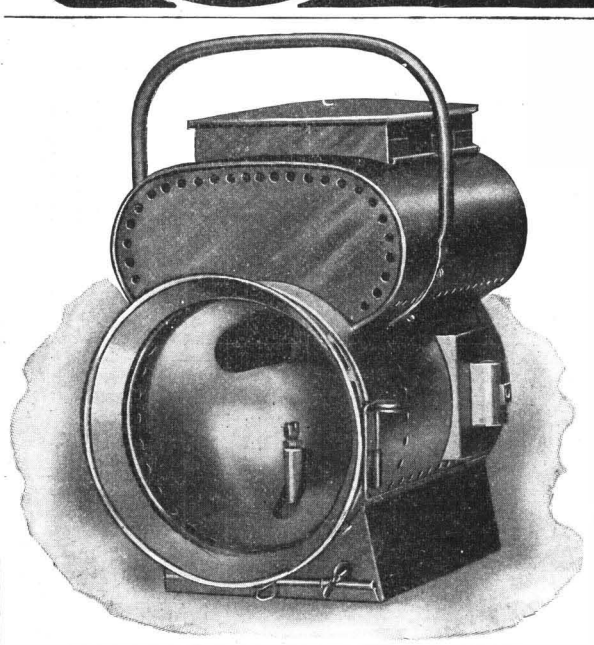

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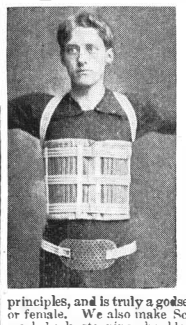

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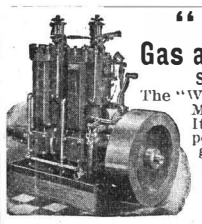

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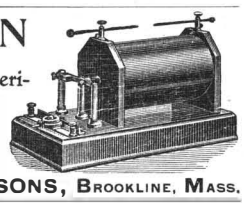

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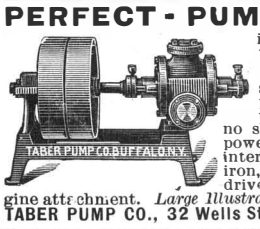

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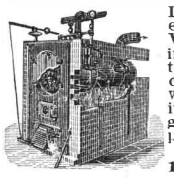

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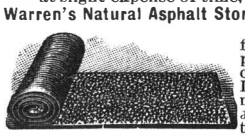

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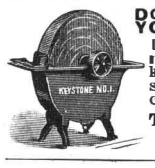

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RECENTLY PATENTED INVENTIONS.

Machine Tools.

TIRE-SETTING MACHINE.—JOHN M. DECKER, Kingston, Ohio. The invention relates to improvements in machines for setting rubber tires on wheels, which are held by a metal band extended through the tire. The machine which Mr. Decker has provided for this purpose is of such construction that the tire can be quickly set or applied without removing the wheels from the machine. The tire can be made even and smooth at all parts of the wheel.

SHARPENING-MACHINE FOR DRILL-BITS.—THEODORE H. PROSKE, Victor, Col. The object of the invention is to provide a new and improved sharpening-machine for quickly and accurately fashioning and sharpening the bits of machine-drills. The sharpening-machine consists of a die toward and from which a dolly reciprocates. The die and the dolly have registering bevels to serve as a protection to the shaping part of the dolly and as a guide and bumper.

Tools.

WATCHMAKERS' TOOL. — SAMUEL W. CHRISTINE, Washington, N. J. The tool is especially adapted for use in setting roller-jewels in a watch-balance. The tool is so designed that the jewel can be held in position for setting and the balance held through the medium of its staff on the tool adjacent to the jewel. The tool is provided with a locking device for the balance, having a member prepared to punch out old jewels.

DENTAL INSTRUMENT. — NEWTON T. YAGER, Louisville, Ky. The tool is especially designed to enable a dentist to force bands, caps, or crowns conveniently, securely, and rapidly in position on the teeth of the upper and lower jaws at either side. No injury is sustained by the band, cap, or crown during the application.

PRUNER.—JOHN P. M. JOSEPH, Manhattan, New York city. By means of this pruner a gardener may stand on the ground and conveniently reach the branches of fairly tall trees. The invention comprises parts forming pruning shears or blades. These parts are mounted on a pole, which may be of any length desired; and they are operated by a hand-lever arranged at the lower part of the pole in such a manner that the operation can be brought about by movement of the operator's hands in much the same way as a pair of shears are worked.

WRENCH.—PATRICK W. WALSH, Butte, Mont. The improved wrench is intended to be used upon pipes or the bodies of bolts. To this end the gripping surfaces of its jaws are specially fashioned. By reason of this peculiar construction and by reason of the efficient operative mechanism provided to adjust the moveable jaw, an implement is produced which is extremely efficient and yet cheap.

SEWING-MACHINE HEMMER.—ALBERT H. DEVOE, Chicago, Ill. All the parts of the hemmer are integral. The implement yields equally well in any direction in which the pressure is brought without correspondingly binding upon other parts of the material passing through it. The novel features are to be found in a presser-foot having a spring folding-plate projecting forwardly, branching at each side, and bowed downwardly and inwardly. One of the branches is provided with a rearwardly-projecting turning scroll-plate and a rearwardly-projecting tongue located in the axis of the scroll. Both of these members are held at their forward ends only and are free to spread in any direction to permit the passage of heavy seams or welts, while the hem is turned in a perfect manner without stretching the hemmed edge or retarding the passage of the goods.

Vehicles and Their Accessories.

VEHICLE-SPRING.—ZACHARIAH T. BUSH, Grandledge, Mich. The inventor has devised a simple construction by which to secure a considerable length of spring within a given space by forming scrolls at the ends and by leaving the center of the springs free. A novel construction of spring-bar supporter at the center of the spring is provided.

Mechanical Devices.

REEL FOR TAPE-MEASURES.—VICTOR G. HILLS and JOHN E. CHAPSON, Cripple Creek, Col. The reel permits the use of a long, narrow piece of steel tape, band, or wire, and is arranged to permit a ready winding or unwinding of the tape, band or wire without danger of the wound-up portion's uncoiling accidentally from the reel—a tendency which it has from its own elasticity when tension is relaxed.

CRANE.—SETH L. BATZEL, Reading, Pa. The crane is intended to lift and handle crucibles. By its means, the crucible can be effectively and readily handled without the necessity of the workman's going close to the furnace. The workman can stand at a safe distance and manipulate a crucible of far greater size than is possible with the methods at present followed.

DEVICE FOR TRANSFERRING CHECKS, TICKETS, ETC.—JACOB C. WOLFE, Manhattan, New York city. The device is to be used in connection with a typewriting machine and is so constructed that checks, tickets, or other mat-

(Continued on page 163)

ter to be tabulated can be quickly taken up in a mass and delivered singly to a table in front of the operator. From this table or support the document delivered can be readily discharged to make room for a following paper from which a record is to be made. The check or ticket is picked up by foot operative means.

VIBRATING SIGN.—Ernest B. Lydick, Pittsburg, Pa. This advertising sign is to be displayed in the cars of cities. The object is to provide a sign that has portions arranged to move in such a manner as to attract attention. The working parts of the sign simulate the waves of water.

CAPPING OR DECAPPING MACHINE FOR CARTRIDGE SHELLS.—James E. Stockdale, Sheldon, Mo. The machine comprises a primer-removing device and a primer-replacing device. These devices comprise a lever having a punch and a presser. A removable die receives and holds the shell. In the die is an ejector. A support for the die moves with the lever.

AUTOMATIC WEIGHING-MACHINE.—William Brough, 412 West 28th Street, Baltimore, Md. This invention is an improvement upon a similar machine patented by Mr. Brough in April, 1901. The present apparatus is particularly adapted for measuring liquids, but can also be used for granular substances with some slight modification.

ARTIFICIAL FUEL COMPRESSOR.—Marcus L. Bratton, Luray, Kans. In the West, where wood is scarce and coal expensive, there is a demand for a cheap fuel. The wheat fields supply an abundance of straw, much of which is allowed to go to waste. In recent years petroleum suitable for fuel has been found in large quantities. Straw when compressed does not burn well, but has a tendency to smother; while petroleum requires a special form of stove. Mr. Bratton's invention contemplates the combining of straw and crude petroleum to form an artificial fuel that can be formed in small bales of six to eight inches square, and that can be burned in any kind of a stove.

Railway Appliances.

CAR-FENDER.—Clifton M. Moore, Monroe, Me. The fender consists essentially of two shafts geared together to rock in opposite directions, one of the shafts carrying short teeth and the other long curved teeth. The obstacle on the road, as it strikes the teeth of the first-named shaft, causes the shaft to rock, so that the teeth of the second-named shaft are thrown down to receive the obstacle. Devices are also provided whereby the teeth of the first-named shaft can be adjusted to conform with the varying load on the car and the inequalities of the road.

Miscellaneous Inventions.

SUSPENDER ATTACHMENT.—Philip H. Bloom, Tidioute, Pa. The invention relates to improvements for attachments for trousers suspenders when worn beneath a shirtwaist. The suspender attachment comprises a strip of metal bent to form a button-engaging lower portion, and having its upper-end members turned inward and then outward, the upper members being spaced apart.

FLOAT-STRINGER.—William T. Jones, New Westminster, Canada. The invention relates to a device for string-net floats; and it comprises a standard forming a sort of needle, at the upper end of which is an eye to receive the end of a cord, so that the floats can be placed one above the other over the needle and cord and then removed with the cord. Thus the floats are all held together on the cord.

BAR-FIXTURE.—William E. Poate, Neillsville, Wis. The invention is the combination of a tray having a sloping bottom, supporting bars fixed above the bottom of the tray, and rinsing bowls and an icebox or bottle rack suspended by the bars within the tray. Each receptacle drains into the tray so that all parts are kept comparatively free from water.

WINDOW-SCREEN ATTACHMENT.—Francis C. Wright, Cave Spring, Ga. The attachment is so constructed and arranged that an opening is formed near the top of the sash, which opening allows a passage for flies and other insects, the width of such opening being adjustable. Flies and various other small insects have the instinct to pass up into the opening; but none will enter through it.

SODIUM SULFOGUAIACOLATE AND PROCESS OF MAKING THE SAME.—William C. Alpers, Bayonne, N. J. The invention provides new improvements in the manufacture of guaiacol derivatives, whereby sodium sulfoguaiacolate or sodium ortho-guaiacol sulfonate is produced. The process consists in treating guaiacol with sulphuric acid to form a thick, red mass, which is subjected to the action of calcium carbonate to form calcium sulfoguaiacolate. The calcium sulfate is precipitated; and the solution is then treated with sodium carbonate to precipitate calcium carbonate and to produce sodium sulfoguaiacolate in solution containing two different guaiacol salts. These two salts are separated to produce sodium sulfoguaiacolate in crystalline form.

Designs.

SHOE-BLANK.—John S. Busey, Brooklyn, New York city. The principal feature of this design consists in providing a shoe-blank with transversely disposed ribs or corrugations.

Note.—Copies of any of these patents will by furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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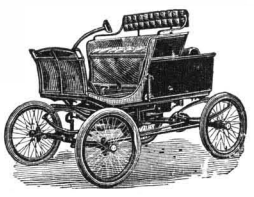

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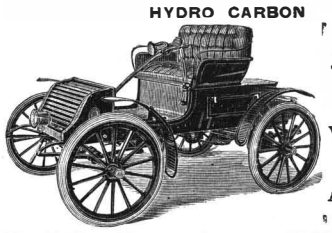

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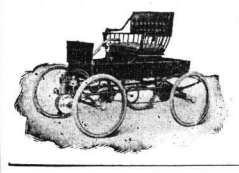

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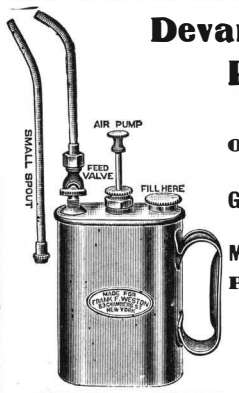

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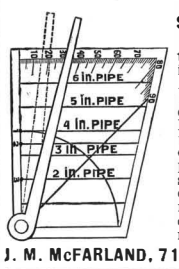

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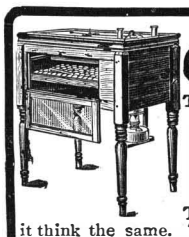

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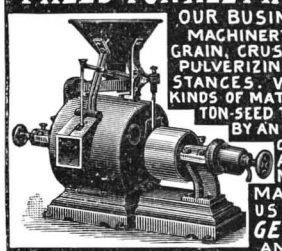

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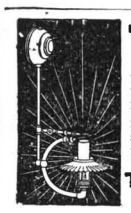

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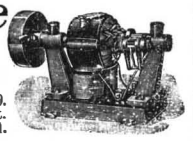

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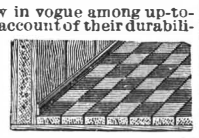

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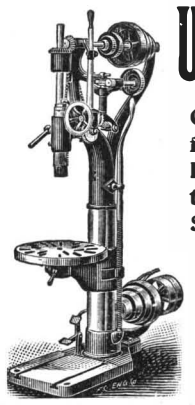

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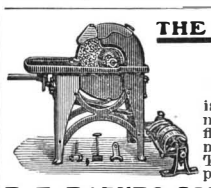

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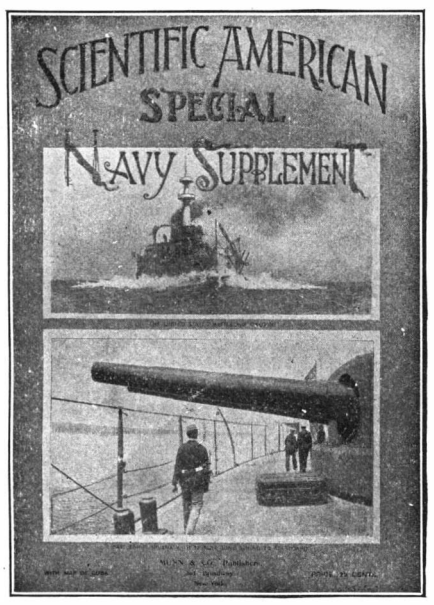

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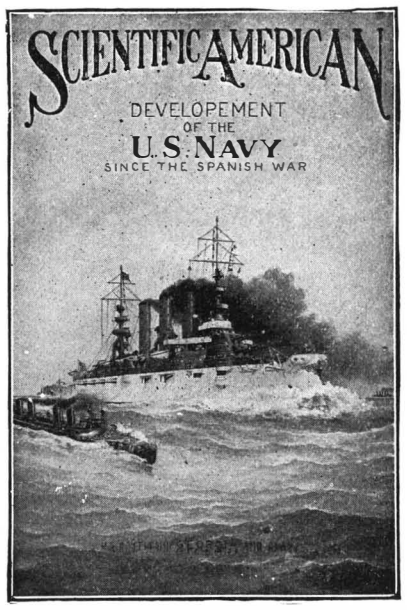

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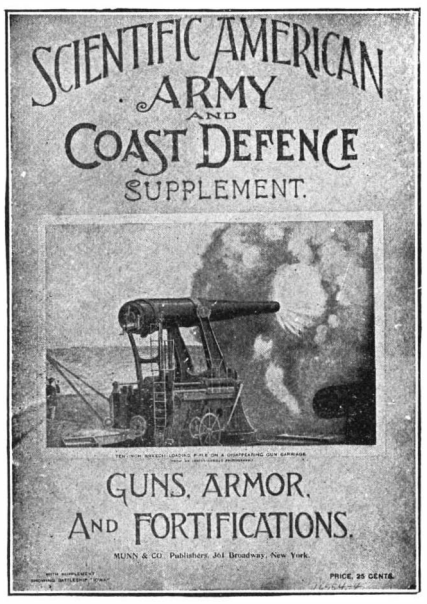

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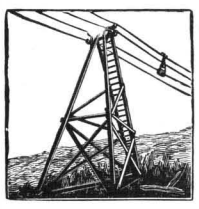

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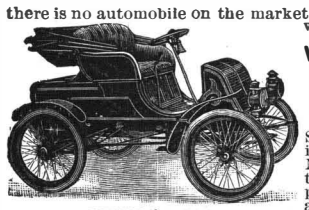

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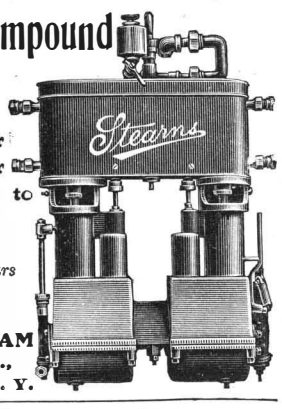

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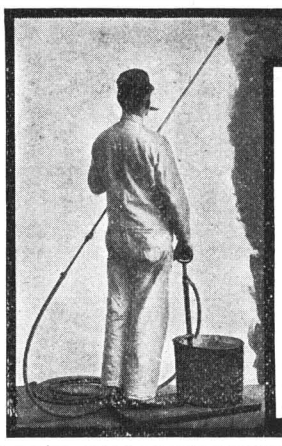

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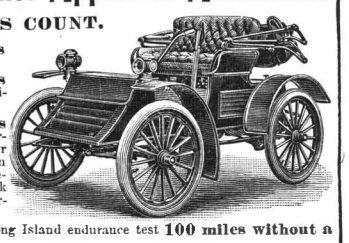

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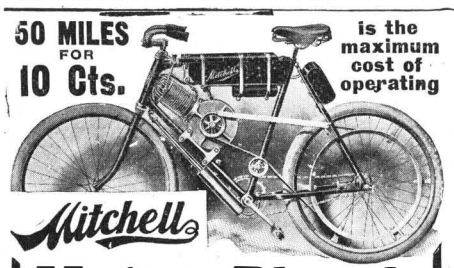

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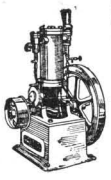

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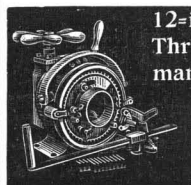

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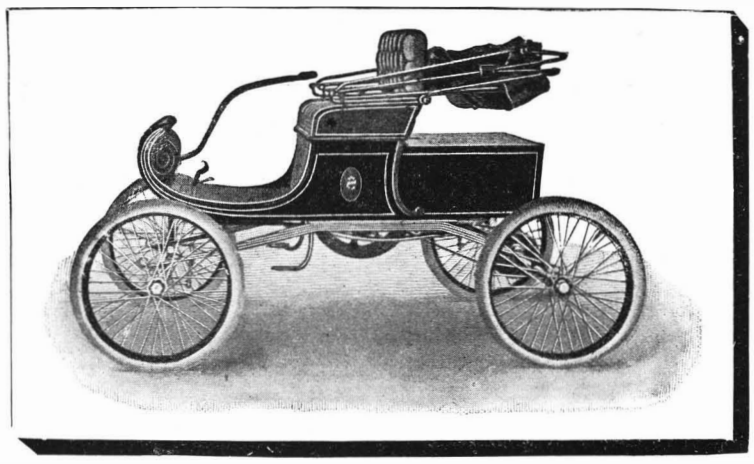

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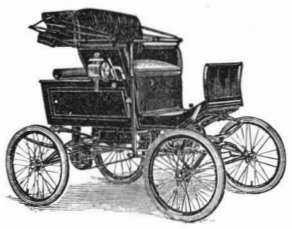

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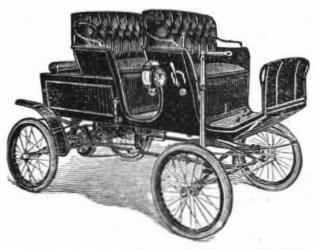

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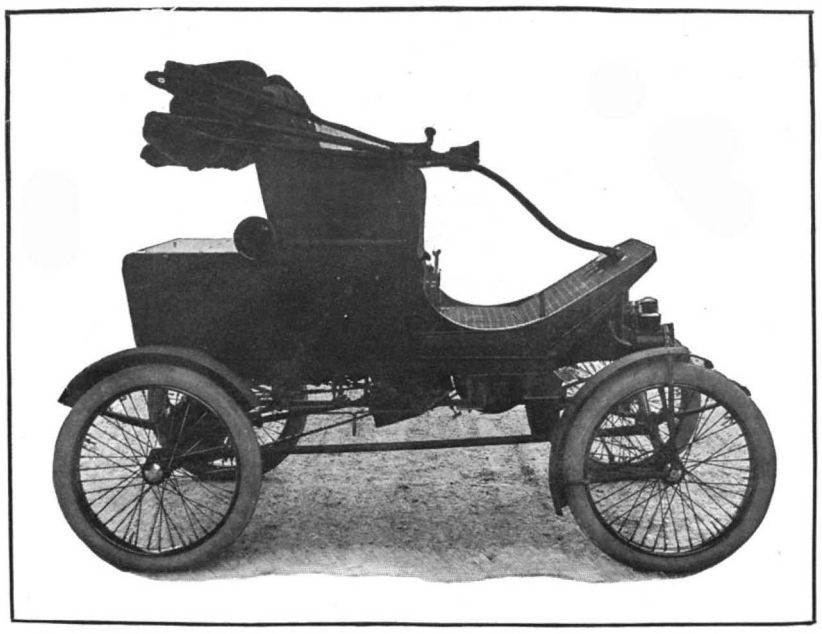

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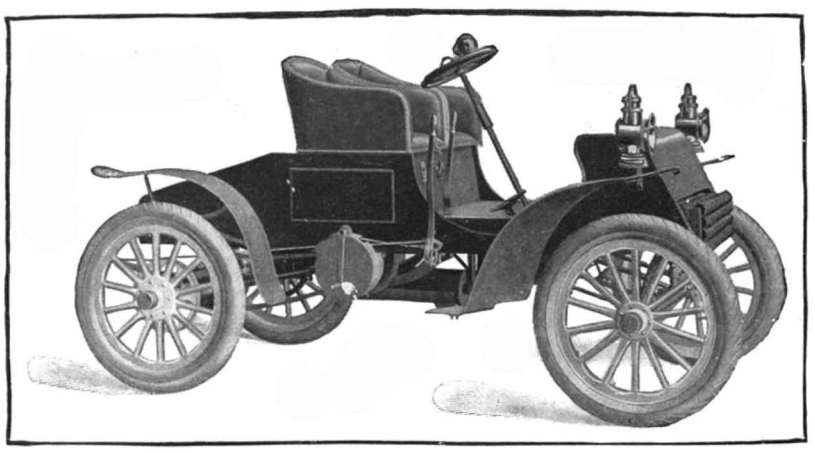

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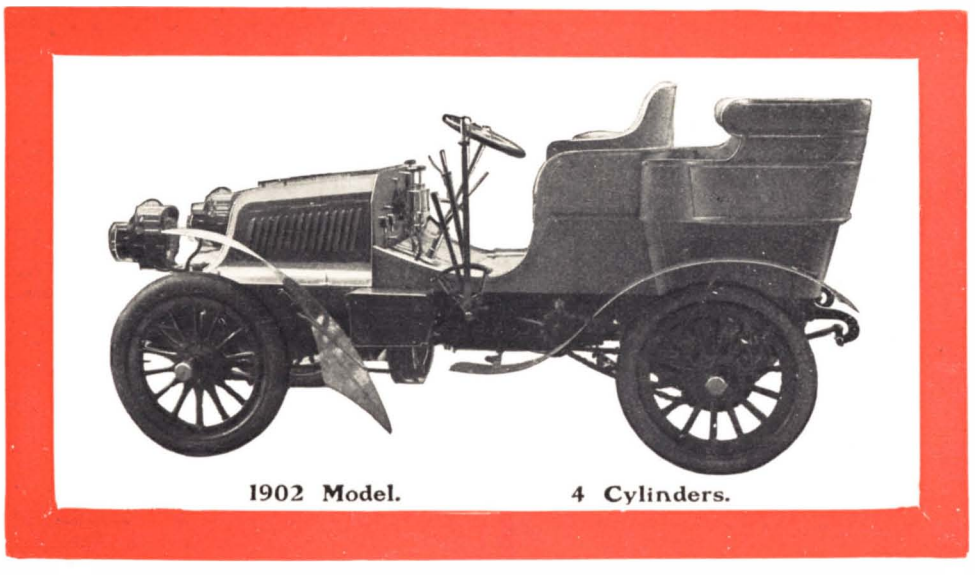

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